

CHEMICAL CONSEQUENCES OF AIR QUALITY STANDARDS AND OF CONTROL IMPLEMENTATION
PROGRAMS: ROLES OF HYDROCARBONS, OXIDES OF NITROGEN AND AGED SMOG
IN THE PRODUCTION OF PHOTOCHEMICAL OXIDANT

Contract No. 3-017
California Air Resources Board
Final Report
July 1975

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ABSTRACT

Construction, testing and validation has been completed of the environmental chamber facility originally conceived and established at the Statewide Air Pollution Research Center, U. C. Riverside, under a joint Air Resources Board-University of California (Project Clean Air) program. Subsequently, this facility which consists of two 6000 liter smog chambers, a 25,000 watt solar simulator, a special high capacity air purification system and a comprehensive array of supporting analytical instrumentation was employed to generate an experimental data base:

- For evaluating the effectiveness of various technical approaches to oxidant control in the California South Coast Air Basin (SCAB), and
- For assessing the impact of incremental control strategies such as new car emission controls, vehicle inspection and maintenance programs, etc.

Development and validation of a "surrogate" mixture of hydrocarbons (HC), carbon monoxide and oxides of nitrogen (NO_x) representative of the pollutant mix in the greater Los Angeles area was followed by more than 60 irradiation experiments of 2, 6 or 9-hour duration. These were conducted at concentration levels ranging from those presently observed in the SCAB down to those predicted from the implementation of emission control strategies aimed at meeting State and Federal ambient air quality standards for non-methane hydrocarbons, NO_2 and oxidant.

By combining results from these experiments with appropriate analyses of available ambient air quality data, initial assessments have been made of:

- The degree of HC and NO_x control required to meet the California air quality standard for oxidant in the SCAB, and
- The possible effects on oxidant levels in the SCAB due to various incremental reductions in HC and NO_x .

Additional achievements include the discovery that commercial chemiluminescent NO- NO_2 analyzers respond essentially quantitatively in the NO_2 mode to a host of nitrogen containing compounds including peroxyacetyl nitrate (PAN) and organic nitrates and nitrites, and the determination of the reactivities of selected aromatic hydrocarbons with the hydroxyl radical, a key intermediate species in photochemical smog.

This report was submitted in fulfillment of Contract No. 3-017 by the Statewide Air Pollution Research Center, University of California, Riverside, under the partial sponsorship of the California Air Resources Board. Work was completed as of June 30, 1974.

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EXECUTIVE SUMMARY

- The smog chamber study described in this report was comprised of some 100 experiments resulting in the generation of a large and detailed data base which established quantitative relationships between initial HC- NO_x precursor levels and key photochemical smog manifestations, reactivity parameters, and secondary products.

- This study included the specific determination of ozone (as well as of total oxidant) and complete detailed hydrocarbon analysis for C₁-C₉ including aromatics and oxygenates, providing data not generally available from previous chamber studies of this kind.

- A unique smog "surrogate" was designed to simulate the current hydrocarbon- NO_x primary pollutant mix in Los Angeles from all major sources, not just auto exhaust. Experimental and empirical tests of the correspondence of the resulting smog chamber data to smog manifestations observed in ambient air, suggest that a simulation of substantial validity has been achieved.

- Initial analysis of the chamber data suggests (within the limitations and assumptions detailed in the report) that to achieve the California ambient air quality standard for oxidant everywhere in the South Coast Air Basin (SCAB), reductions will be required in 6-9 AM non-methane hydrocarbons (NMHC) of the order of 88-95% (depending upon the corresponding NO_x reduction) from the highest ambient 6-9 AM NMHC concentration observed at LAAPCD Station 001 in 1974.

- This investigation confirmed results obtained in previous smog chamber studies that, with respect to the present SCAB atmosphere, if reductions in ambient levels of NO_x are achieved, more stringent reductions in ambient non-methane hydrocarbon levels will be necessary to achieve the same reduction in oxidant concentrations, as in the absence of the NO_x reduction.

- Prototype calculations estimating the impact of "incremental" emission control programs such as the 1966-1970 light duty vehicle NO_x retrofit program in the SCAB were made using the HC- NO_x -ozone data base

generated in this program. Results from these calculations support the validity of the "linear rollback of hydrocarbons" concept even if hydrocarbon rollback is accompanied by modest simultaneous reductions in oxides of nitrogen.

- The relative reactivities of tri-substituted benzenes and other selected aromatic compounds with the hydroxyl radical were accurately determined in a series of special chamber experiments designed to minimize reaction of the aromatics with other reactive intermediate species.
- Calculations have been carried out which provide a preliminary statistical basis for relating SCAB ambient air quality data to the smog chamber data in such a way as to permit prediction of the frequency-of-violation of the California ambient air quality standard for oxidant in future atmospheres resulting from given reductions in ambient NMHC and NO_x concentrations.
- Careful monitoring and analysis during the course of the smog surrogate study led to the discovery that commercial NO-NO₂ chemiluminescent analyzers respond quantitatively in their NO₂ channels to a variety of nitrogen containing compounds including PAN and organic nitrates and nitrites.

RECOMMENDATIONS

- In utilizing the smog chamber data obtained in this study to calculate the impact on ambient levels of oxidant of various control measures, the crucial need for far more accurate, detailed and extensive emissions inventories of hydrocarbons (including solvents) and NO_x once again became evident.
- A difficulty encountered in employing existing ambient air quality data was the differences in definitions of "reactive hydrocarbons" used by different control agencies. Thus the derivation of valid reactivity scales for hydrocarbons which can be applied in a consistent manner by all air pollution regulatory agencies should have a high research priority.
- A second difficulty encountered in using ambient air quality data from the South Coast Air Basin was related to the discrepancy between ozone calibration methods used by the LAAPCD, the ARB, and the EPA. This discrepancy may also affect the validity of measurements of NO in certain air monitoring networks in which NO is calibrated by gas phase titration with ozone. An urgent need clearly exists for more uniform measurement and calibration methods in the air monitoring networks in the South Coast Air Basin.
- To improve the applicability of the HC-NO_x-Ozone data base generated in this program to assessments of the impact on oxidant levels in SCAB of various emission control strategies, additional chamber studies should be initiated which extend the period of irradiation to 9-12 hrs and which simulate air parcel transport by adding dilution and fresh injection of hydrocarbons and oxides of nitrogen to the experimental protocol.
- In view of emerging energy policies which could result in substantially enhanced SO₂ and sulfate levels in the SCAB in the near future, the current chamber studies should be extended to include systematic investigation of the effects on reactivity and secondary product formation of the addition of SO₂ to the HC-NO_x smog surrogate irradiations.

- As shown in this report, the feasibility of obtaining accurate, quantitative data for the relative reactivities of hydrocarbons with the hydroxyl radical has been demonstrated in a series of special glass chamber experiments. Such special experiments should be continued for a larger number of atmospherically important natural and anthropogenic hydrocarbons so that a reactivity scale based on a reaction with the important intermediate species, OH, can be established.

ACKNOWLEDGEMENTS

Stimulating discussions and valuable exchanges of technical information, for which we express our appreciation, took place at various times during this program with the following members of the California Air Resources Board staff:

Dr. Al Bockian
Mr. Frank Bonamassa
Dr. Robert Grant
Dr. John Holmes
Mr. Dale Hutchison
Dr. Jack Suder

The staff of SAPRC conducting this ARB program gratefully acknowledge contributions to the program by the following people and organizations:

- The Thermo Electron Corporation (Mr. James Nelsen) and Monitor Laboratories (Mr. Neil Charlton) for use of NO-NO₂ chemiluminescent analyzers for evaluation prior to purchase.
- The Science Center of Rockwell International and Dr. George Lauer in particular for providing the specifications and drawing for the calibration system for gas phase analyzers developed by Rockwell.
- The Beckman Corporation for an extended loan of a Beckman 6800 Air Quality Chromatograph for use in our environmental chamber studies.
- The California Air Resources Board, and the air pollution control districts of Los Angeles, Riverside and San Bernardino Counties for supplying recent air quality data.

Finally, we gratefully acknowledge the continuing financial support by the California Air Resources Board of the smog chamber program performed under this contract.

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ALL OZONE DATA REPORTED IN THIS STUDY
WERE OBTAINED WITH INSTRUMENTS CALIBRATED
AGAINST 2% NEUTRAL BUFFERED POTASSIUM
IODIDE. UNLESS SPECIFICALLY NOTED OTHERWISE
THE OZONE DATA ARE UNCORRECTED.

The statements and conclusions in this report are those of the contractor and not necessarily those of the California Air Resources Board. The mention of commercial products, their source or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such products.

I. INTRODUCTION

A. Scope and Purpose

The Environmental Protection Agency (EPA) implementation plan for achieving the Federal air quality standard for oxidant in the California South Coast Air Basin (SCAB) presented on January 15, 1973, proposed imposition of drastic levels of gasoline rationing during months of heavy smog. This control strategy was based on the assumption that the yearly high one-hour ambient oxidant^{*} reading on a given day is directly proportional to the amount of "high reactive" hydrocarbon emissions for that day.¹ The possible role of oxides of nitrogen (NO_x) in determining the ambient oxidant levels was not considered in the EPA implementation plan.

In contrast, the California Air Resources Board (ARB) has approached the problem of achieving air quality standards for oxidant on the basis of reductions in emissions of both reactive^{*} hydrocarbons (HC) and NO_x . The major goal of the work reported here is to establish an experimental basis for the evaluation of the effectiveness of these approaches in achieving acceptable levels of photochemical oxidant.²

The environmental chamber facility at the University of California Statewide Air Pollution Research Center (SAPRC), which was designed and constructed with the support from the ARB,^{3,4} was utilized in a study of hydrocarbon-oxides of nitrogen (HC- NO_x) mixtures irradiated under conditions simulating those found in the South Coast Air Basin. The systems studied included HC and NO_x concentrations ranging from those found in a present-day polluted atmosphere down to those to be expected from the implementation of emission control strategies aimed at meeting the State and Federal ambient air quality standards.

B. Background

Although many pertinent experimental studies have been carried out in the two decades since Haagen-Smit⁵ established that photochemical smog results from the ultraviolet irradiation of hydrocarbons and

* See Glossary, page 99

oxides of nitrogen, the problem of how to most effectively reduce the formation of photochemical oxidant in polluted urban atmospheres has still not been adequately answered. This is apparent in the fact, as indicated above, that different air pollution control agencies are advocating different hydrocarbon and NO_x control strategies. The lack, even at this late date, of a definitive technical basis for resolving this problem arises from the great complexity inherent in the photochemical smog phenomenon.

Chamber studies dealing with the interrelations of HC, NO_x and photochemical smog manifestations have generally utilized either auto exhaust or pure organic compounds (e.g., propene or butane) as the hydrocarbon component. Studies using pure hydrocarbons, either singly or in simple mixtures, have provided valuable information on the mechanisms of reaction and on the relative reactivity of these compounds,⁶⁻¹¹ but they are not directly applicable to predicting the production of oxidant under present and future ambient conditions which involve complex multi-component mixtures of hydrocarbons. Also, in several of these studies the concentrations of NO_x and HC used were well above present-day levels. Studies utilizing auto exhaust¹¹⁻¹⁶ have given closer approximations to the conditions found in ambient air and have provided the basis for the view that both HC and NO_x must be controlled in order to reduce photochemical oxidant. The relatively recent work of Dimitriades^{15,16} is the most important example of such a study.

For the work undertaken here, it was decided to use a synthetic mixture of hydrocarbons and oxides of nitrogen to serve as a surrogate for the pollutant mix found in general in the South Coast Air Basin and, in particular, in Los Angeles. This choice was made, in part, to avoid four serious difficulties associated with the use of auto exhaust: (1) nonreproducible starting composition, (2) particulate contamination of the chamber, (3) inability to achieve very low NO_x concentrations, and (4) the absence in auto exhaust alone of other hydrocarbons which are found in abundance in the Los Angeles atmosphere from natural gas and evaporative and geogenic sources.

The composition of the surrogate mixture as given in Table 1, was selected to be representative of, but considerably simpler than, the

composition of a typical early morning polluted atmosphere in Los Angeles.⁴ Such a typical polluted atmosphere was defined as one produced from automotive exhaust, evaporative emissions and natural gas leaks. The hydrocarbon content of this polluted atmosphere was further subdivided into six major pollutant groups. The selection of individual components within these pollutant groups involved the following judgments: (a) naturally abundant compounds were chosen, (b) compounds of high and low reactivity were selected when both types normally are found within the pollutant group, and (c) compounds were omitted that would present special problems in gas chromatographic analyses. The concentrations were based on an evaluation of analyses of atmospheric hydrocarbons in Los Angeles and Riverside Counties.¹⁷⁻²⁰ In addition to the components given in Table 1, the standard surrogate mixture contains water at 50% relative humidity (~30°C).

Based on direct comparisons with observed ambient air monitoring data and chamber irradiations of ambient air,⁴ the following criteria were selected for determining the acceptability of the surrogate mixture:

- (1) Oxidant concentration (2% neutral buffered KI method) \approx 0.45 ppm after 3-4 hours of irradiation
- (2) Nitrogen dioxide peak concentration \leq 0.25 ppm
- (3) Aldehyde concentrations after 3-4 hours of irradiation should be 100-200 ppb each of formaldehyde, and total aldehydes except formaldehyde
- (4) Comparable rates of hydrocarbon disappearance for the surrogate mixtures and an ambient sample irradiated in the chamber under comparable conditions

Using these direct comparisons, as well as several indirect criteria, it was found that the standard surrogate mixture with the nominal concentrations given above gave satisfactory results when irradiated in the glass chamber at a light intensity 70% of the maximum possible.⁴

Table 1. Surrogate Mixture for Simulation of the 6-9 AM Ambient Pollutant Burden in Los Angeles

Pollutant Group	Initial Concentration	Individual Components, Nominal Concentration
Aromatics	440 ppbC	Toluene, 115 ppbC m-Xylene, 325 ppbC
Saturates	1400 ppbC	n-Butane, 785 ppbC 2,3-Dimethylbutane, 615 ppbC
Fuel olefins	130 ppbC	cis-2-Butene, 60 ppbC 2-Methyl-2-butene, 70 ppbC
Cracking products	220 ppbC	Ethylene, 84 ppbC Propene, 35 ppbC Acetylene, 101 ppbC
Oxygenates	65 ppbC	Formaldehyde, 54 ppbC Acetaldehyde, 5 ppbC Acetone, 6 ppbC
Natural gas components	3000 ppbC ppbC	Ethane, 160 ppbC Propane, 40 ppbC Methane, 2800 ppbC
Carbon monoxide	7000 ppb	
Nitrogen oxides	300 ppb	NO, 270 ppb NO ₂ , 30 ppb

II. FACILITIES AND METHODS

A. General Experimental Procedures

The major components of the SAPRC environmental chamber facility are an evacuable chamber with a specially designed 25-KW solar simulator as the irradiation source, an all-glass chamber equipped with fluorescent black lights, and an air purification system.^{3,4,21,22} This study employed the 6400 liter all-glass chamber shown schematically in Figure 1. With this chamber, two diametrically opposed banks of black lights are set in specially designed reflectors which provide moderately uniform light intensity throughout the chamber volume. Between experimental runs the chamber was flushed with dry air provided by the pure air system²¹ (depicted in Figures 2 and 3) for about 2 hours at a flow of 12 cfm. The chamber was flushed with humidified pure air for about one hour just prior to the start of a run to achieve the desired initial relative humidity of 50% and the temperature was adjusted to the approximate operating temperature by means of infrared lamps (beginning with Run No. 23-E). During all flushing procedures, two sonic pumps were in operation to provide maximum release of materials from the chamber walls.

The matrix air used during the flushing procedure and for the final fill for the experiment typically contained less than 60 ppbC of all hydrocarbons except methane (typically 550-850 ppb). After completion of filling, analysis of the matrix air prior to injections showed somewhat higher hydrocarbon values due to off-gassing from the chamber walls, but generally these values were less than 200 ppbC non-methane hydrocarbon.

Following flushing and establishment of appropriate temperature and relative humidity values, background levels of oxides of nitrogen, carbon monoxide and methane, were also measured. Appropriate amounts of all starting materials were then injected using 100 ml precision bore syringes and rapid mixing was obtained by brief use of the sonic pumps. During the run, the sample temperature was controlled to $31 \pm 1^{\circ}\text{C}$ by means of a variable air flow past the chamber walls.

The surrogate hydrocarbons were injected as samples from previously prepared mixtures. The liquid hydrocarbons were contained in a

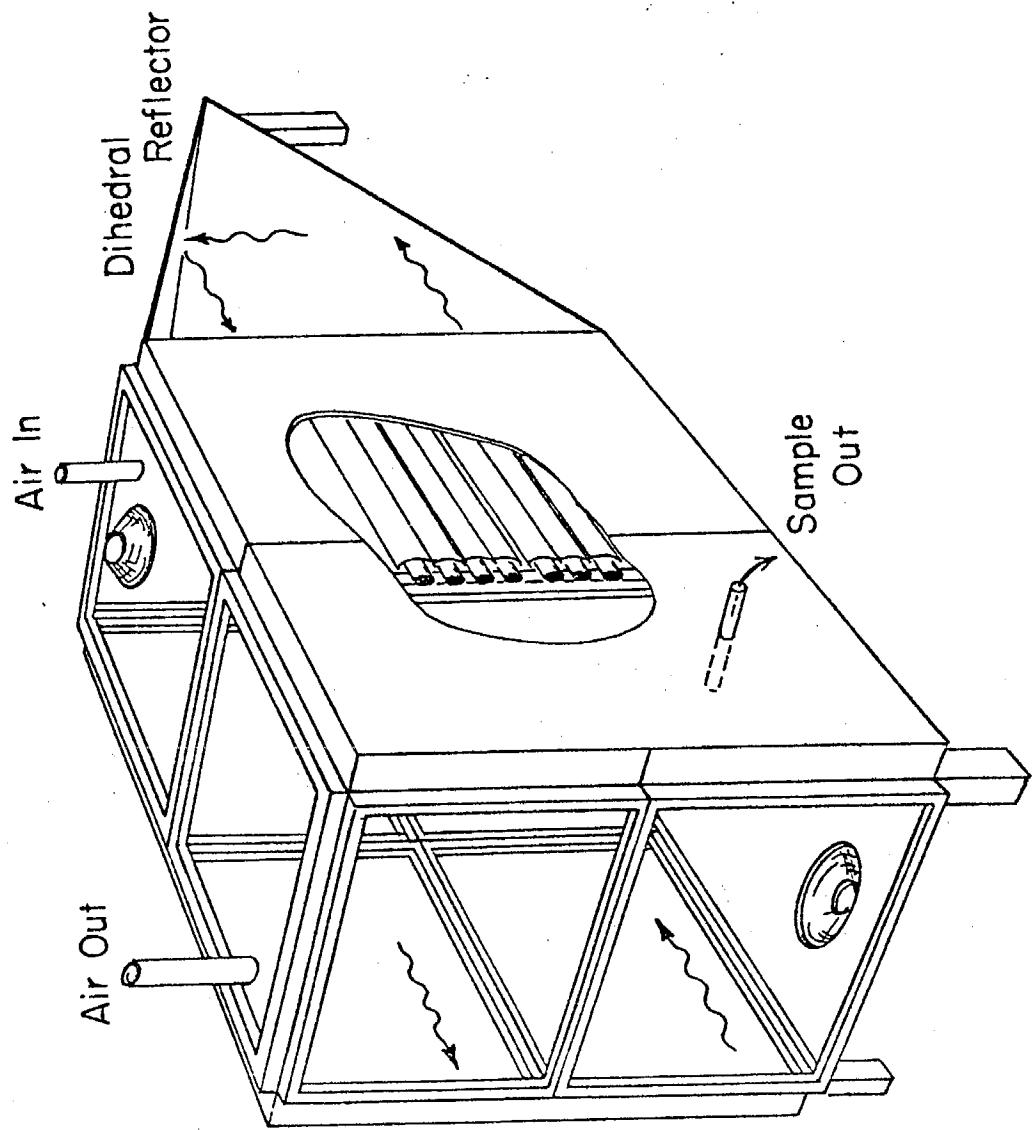


Figure 1. SAPRC All-Glass Chamber

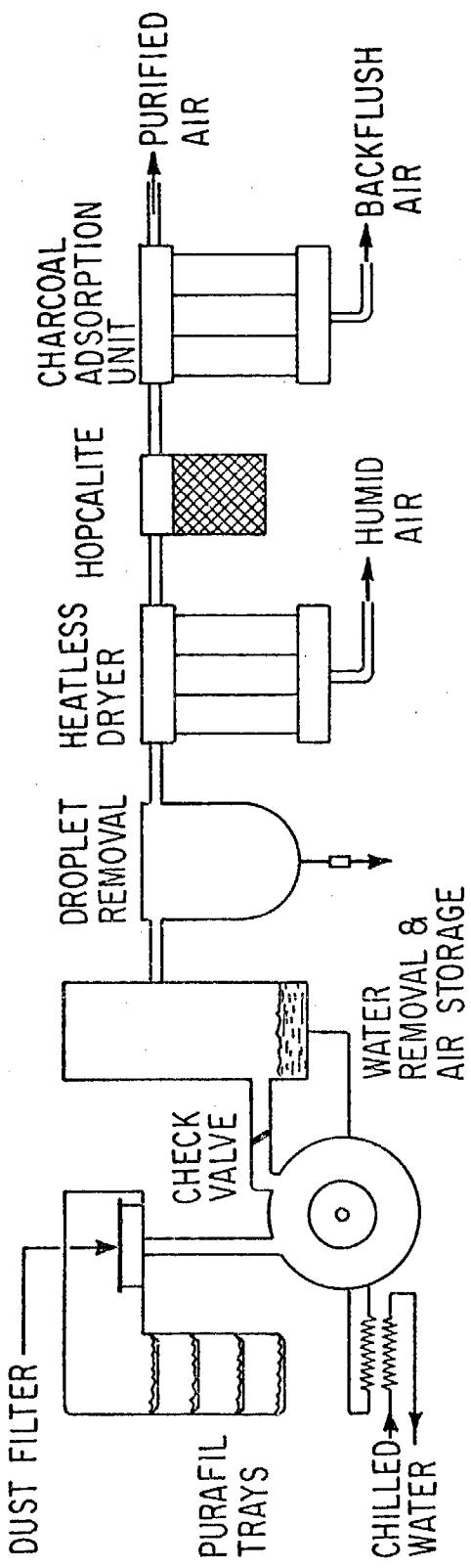


Figure 2. SAPRC Air Purification System

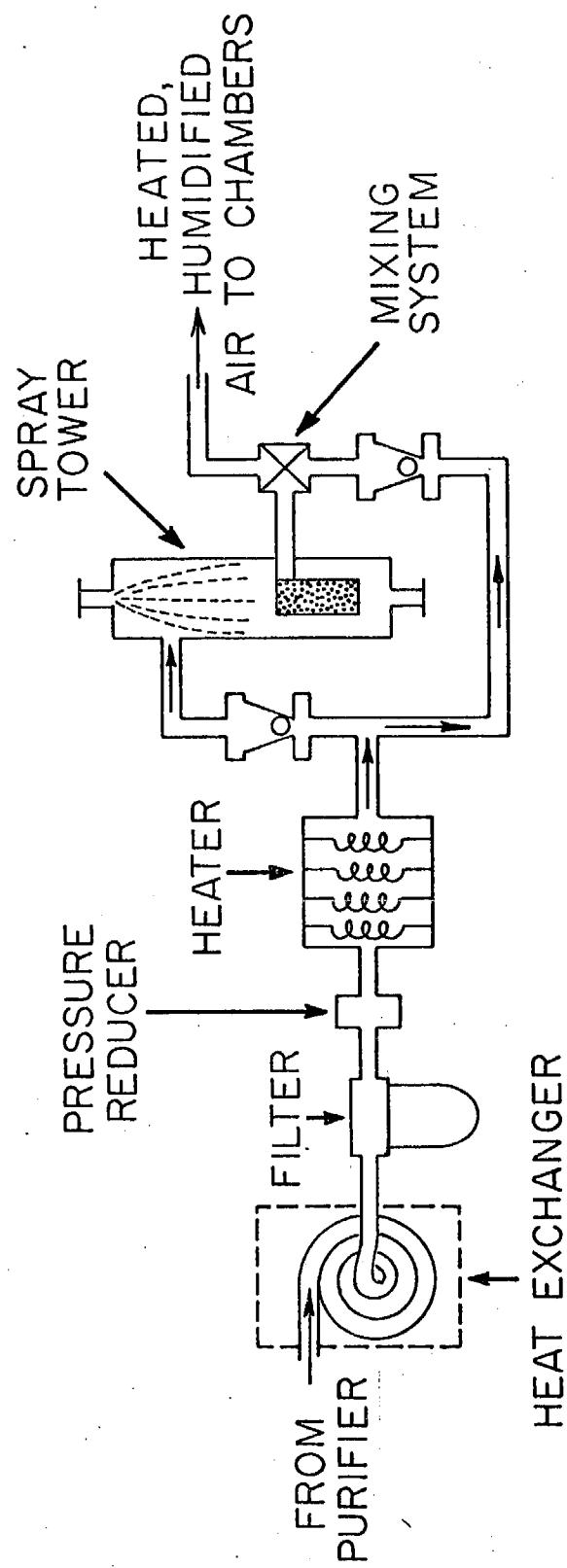


Figure 3. Humidity and Temperature Control Segments of the Air Purification System

nitrogen-filled 20 l Pyrex bottle and the gaseous hydrocarbons in an LPO bottle pressurized with nitrogen.

The method of Holmes et al.²³ was employed to determine the initial rate (k_1) of NO_2 photolysis as a measure of absolute photon flux in the glass chamber in the actinic region (300–450 nm). Typically, it has been found that near the beginning of the life of a given set of black lamps installed in the glass chamber light banks, k_1 was approximately 0.3 min^{-1} for 70% of the lamps on (the operating condition for this series of experiments). Near the end of the usable lifetime of a set of black lamps, k_1 approached a value of 0.2 min^{-1} . During the period of experiments, from which data were employed in deriving quantitative conclusions in this report, k_1 is taken to be $0.25 \pm 0.03 \text{ min}^{-1}$. However, it should be noted that this is felt to be a lower limit to k_1 in the glass chamber since this chamber cannot be evacuated but instead must be flushed repeatedly with N_2 in order to conduct the k_1 actinometry experiment. Invariably, some O_2 will be present in the chamber even if only at the part per million level, but more likely at tens to hundreds of ppm levels. The effect of any O_2 present will be to result in low values for k_1 as they were calculated in this study, relative to the true k_1 which would be observed for the complete absence of O_2 .²³ Based on the purity of the nitrogen used (with respect to oxygen content) and a calculated efficiency for repetitive flushing, it is estimated that the observed k_1 of 0.25 min^{-1} (for 70% lights) could be as much as 25% low with respect to the true k_1 .

B. Analytical Methods

Ozone (O_3), total oxidant, $\text{NO}-\text{NO}_2-\text{NO}_x$, and carbon monoxide (CO) were monitored using ultraviolet (UV) absorption, coulombmetric KI (Mast analyzer), chemiluminescence and gas chromatography analyzers, respectively. Peroxyacetyl nitrate (PAN) was monitored using gas chromatography with electron capture detection;^{24,25} formaldehyde (HCHO) using the chromotropic acid method.²⁶ Detailed analysis of all other organic compounds were obtained using gas chromatography with flame ionization detection.^{20,27} Relative humidity (RH) was measured

using a Brady array (except for the first eight runs for which a hygrometer was used) and temperature using a 19-35°C (0.01 degree/division) thermometer. The range, precision and accuracy of measurement of each of these parameters are given in Table 2.

The details of the analytical and data processing procedures are described below for each species or variable monitored. Data points were recorded every 15 minutes for the first two hours of the run and every 30 minutes thereafter, except as noted. The data obtained (except for hydrocarbons) are tabulated for each run on an inorganic data sheet (Appendix A) and have not been corrected for losses due to sampling from the chamber.

OZONE was monitored by UV absorbance with a Dasibi Model 1003 analyzer and the digital readout was recorded. A strip chart record was also taken. Calibration was checked periodically using 2% neutral buffered KI solution (see discussion in Section III-C-2) and the factor used (if different than 1.00) is given on each data sheet. Sampling flow rate was 567 ml/min.

Total OXIDANT was monitored using a Mast analyzer which was calibrated in tandem with the Dasibi. The response to O_3 was linear over the range observed during this study (0 to .6 ppm). The calibration was checked periodically using 2% neutral buffered KI solution and the factor used is given on each data sheet. Data points were read from the strip chart. Sampling flow rate was 134 ml/min.

NITROGEN OXIDES were monitored by chemiluminescence from the reaction of NO with O_3 using a Bendix analyzer (Run No. 10-C through 44-E) or a TECO Model 14B analyzer (Run No. 45-E through 73-G). NO is measured directly, NO_x is measured by converting NO_2 to NO over a carbon (Bendix) or molybdenum (TECO) catalyst, and NO_2 is read as the electronically processed difference. Data points are read from a panel meter and a strip chart record of NO and NO_x is also taken. The NO_2 and NO_x data are corrected for 100% of PAN concentration during computer processing of the data since a study²⁸ conducted during this research program showed that chemiluminescent NO- NO_2 analyzers respond quantitatively to PAN (see discussion in Section III-C-1). (Linear interpolation is made between PAN data points.) Calibration was periodically

Table 2. Chemical and Physical Parameters Measured in Glass Chamber Studies

Parameter	Range	Method	Precision	Accuracy
Ozone	0-20 ppm	UV Absorption Analyzer	±1% F.S.	±5%
Total Oxidant	0-1 ppm	Mast Analyzer	±.05 ppm	±.05 ppm
NO	0-5 ppm	Chemiluminescent Analyzer	±2% F.S. By difference	±5% By difference
NO ₂	0-5 ppm		±2% F.S.	±5%
NO _x	0-5 ppm			
PAN	>1 ppb	GC	±0.5 ppb	±10%
Formaldehyde	>10 ppb ^a	Chromotropic Acid	±7 ppb	±10%
Individual HCs	0.5-1 ppb 1-2 ppb >2 ppb	GC GC GC	±15% ±10% ±2%	Limited by calibration standard (typically ±2%) and/or by sampling techniques
CO	0-10 ppm	GC	±2% F.S.	±0.2 ppm
Temperature	15° to 40°C	Thermometer	±0.02°C	±0.5°C
Light Intensity	0-1 Solar Constant	NO ₂ Actinometry	±5%	To be determined ^b
Relative Humidity	0-100%	Brady Array	±0.5% RH	±2%

^a Determined by practical values of sampling time and flow rate.^b See discussion on p. 9.

checked using standard span gases and zero air produced by an EPA approved zero air filter. Sampling flow rate for the Bendix was 150 ml/min and for the TECO, 895 ml/min.

CARBON MONOXIDE (CO) was monitored with a Beckman Model 6800 Air Quality Chromatograph. Data points were read from the strip chart. The instrument was calibrated daily with a standard gas sample. Sampling flow rate was 100 ml/min.

PEROXYACETYL NITRATE (PAN) was monitored by gas chromatography with electron capture detection (GC-ECD).^{24,25} Syringe samples were taken every hour and peak heights were read from the strip chart and converted to concentration units using a calibration factor which was determined periodically. The instrument response was linear over the range of PAN concentrations observed in these runs. PAN data are given on both the inorganic and hydrocarbon data sheets.

FORMALDEHYDE (HCHO) was monitored using the chromotropic acid method.²⁶ Air from the chamber was drawn through a bubbler at the rate of 1 l/min and the total volume per sample determined with a stopwatch. Generally, a 30 min sample was taken. The concentration was recorded at the mid-point of this time interval, except for the initial value which was taken in the 30 min prior to lights on. Beginning with Run 35-E the final sample was taken in the 30 min prior to lights off. Absorbances were read on a Bausch and Lomb Spectronic 20 and calculations of the HCHO concentration from the absorbance and volume of air sampled (HCHO vol) were made from the following equation:

$$\text{HCHO(ppm)} = \frac{\text{HCHO}(\mu\text{g}) \times 2.037}{\text{HCHO(vol)}}$$

where HCHO (μg) is taken from the least squares fit of the experimentally determined calibration function of HCHO (μg) vs absorbance. HCHO data are given on both the inorganic and hydrocarbon data sheets.

The WALL TEMPERATURE (Wall T) was read from a 19-35°C (0.01 degree/division) thermometer taped to the outside of the end window of the chamber.

The SAMPLE TEMPERATURE (Sample T) was read from a 19-35°C (0.01 degree/division) thermometer hung inside the chamber close to the end window where the wall temperature was measured. The thermometer was not in the direct light path and hung free in the chamber.

RELATIVE HUMIDITY (RH) was measured initially via a hygrometer but beginning with Run 19-E with a Brady array (a solid state device) mounted in a bulkhead fitting. The response in volts (V) was recorded from a digital voltmeter and converted to %RH using the calibration function supplied by the manufacturer.

HYDROCARBONS (HC) were monitored by gas chromatography with flame ionization detection (GC-FID), using the columns and methods developed by Stephens and Burleson.^{20,27} Methane and C₂ HC's were analyzed using a 5' Poropak N Column, C₃-C₆ HC's using a 36' dimethyl sulfolane column, and aromatics and oxygenates using a special 3-part column. Each gc was calibrated frequently using specially prepared samples.²⁰ Syringe samples were taken every 120, 30 (60 after fourth hour) and 60 minutes, respectively, for the three columns, and peak heights were read from the strip charts in ppb using a calibrated transparent overlay chart. Computer processing of the data includes calculation of the concentration in ppbC for each data point. These data are given for each run on the hydrocarbon data sheet (Appendix C).

III. RESULTS

A. Experimental Conditions and Raw Data

A total of 95 chamber runs were conducted during this program including chamber characterization experiments (i.e., determinations of k_1 , ozone decay rates, etc.) as well as irradiations of HC- NO_x surrogate mixtures. We present detailed data here for 62 surrogate runs which represent a systematic study of the effect on production of ozone and oxidants of across-the-board reductions in hydrocarbon and carbon monoxide levels at nitrogen oxides concentrations varying from very low levels (~ 0.01 ppm) to levels approaching worst day ambient concentrations in Los Angeles (~ 0.4 ppm).

Table 3 summarizes the average observed initial methane (CH_4), carbon monoxide (CO) and non-methane hydrocarbon (NMHC) concentrations employed for irradiations at each of five sets of concentrations studied as a function of oxides of nitrogen levels. Initial NO_2 concen-

Table 3. Average Initial Concentrations in Surrogate Experiments

NMHC (ppbC)	CH_4 (ppm)	CO (ppm)
2610	2.8	8.3
2110	2.5	6.0
1310	2.1	3.7
690	1.8	1.9
460	1.6	1.4

trations were approximately 10% of the total initial NO_x ($\text{NO} + \text{NO}_2$) concentration except at concentrations below about 60 ppb where a minimum of 7 ppb of NO_2 was required to obtain reproducible values for the rate of NO photooxidation. No corrections were applied to the PAN, O_3 , oxidant or formaldehyde data for variations in initial NO_2 values.

The initial HC and NO_x concentrations for surrogate runs 10-73 are tabulated in Table 4. Each freshly prepared liquid or gas surrogate sample was given a separate letter designation which appears with the surrogate run number (Column 2). The observed surrogate hydrocarbon concentration at T = 0 (Column 4) corresponds to analyses only for those compounds in the surrogate mixture, whereas Column 6 gives the total non-methane hydrocarbon concentration at the beginning of the run including formaldehyde and all non-surrogate trace components in the matrix air. Operating conditions (relative humidity and temperature) and CH₄ and CO concentrations are tabulated in Table 5. Columns 11 and 13 show, in addition to the observed starting concentrations for CH₄ and CO, respectively, the ratio of concentration of these species at 6 hours to the starting concentrations. Differences between temperatures given in Columns 14 and 15 are due to the fact that in some runs the humidity was measured somewhat before the starting time or after the 6-hour point in the run. For purposes of normalizing the relative humidity data to a common temperature, the precise temperatures corresponding to each RH measurement are given in Column 14. All other columns in Tables 4 and 5 are self-explanatory. Runs which have no entries for 6-hour data were special 2-hour irradiations designed primarily to determine the time required to reach a specified ozone level (e.g., 0.08 or 0.10 ppm). Explanatory notes for Tables 4 and 5 are given in Table 6.

A detailed data sheet, listing ozone, oxidant, NO, NO₂, NO_x, CO, PAN, HCHO and temperature values for each run, is given in Appendix A. A concentration-time plot showing ozone, NO, NO₂ and PAN for each of the 6-hour runs is presented in Appendix B. Data from detailed HC analyses are given in Appendix C.

B. Data on Production of Photochemical Oxidants

Detailed data were obtained on the formation of three photochemically produced oxidants; ozone, NO₂ and PAN. Three general types of reactivity parameters have been selected for use in interpreting the results of

Table 4. Initial HC and NO_x Levels for Surrogate Runs 10 through 73

1	2	3		4	5	6	7	8				9
Date	Surro. Run No.	Injected Surrogate (ml)		Observed Surrogate HC T=0 (ppbC)	H ₂ CO T=0 (ppb)	Total Non-CH ₄ HC T=0 (ppbC)	Injected NO _x (ml)	Observed Oxides of Nitrogen T=0 (ppm)				HC/NO _x + T=0
		Gas	Liq.					NO _x	NO	NO ₂	NO ₂ /NO _x	
<u>1973</u>												
Jul 9	10-C*	100	100	1810	-	1924	2.4	.343	.320	.035	.102	5.6
10	11-C	100	100	1868*	74	1970*	2.7	.434	.413	.029	.067	4.5*
11	12-C	100	100	1866*	90	1981*	2.4	.434	.420	.018	.041	4.6*
12	13-C	100	100	1977*	89	2096*	1.0	.200	.184	.028	.140	10.5
16	15-C*	100	100	2004*	86	2127*	0.5	.114	.109	.011	.096	18.7*
17	16-C	100	100	2270	48	2387	0	.008	.006	.002	.250	298.4
18	17-C	100	100	1846*	80	1959*	0.5	.098	.084	.018	.184	20.0*
19	18-C	100	100	1926	78	2026	0.25	.056	.050	.007	.125	36.2
Oct 2	19-E	100	100	1805*	52	2176*	0.125	.046	.042	.004	.087	47.3*
3	20-E	25	25	468	34	564	0.5	.124	.122	.002	.016	4.5
4	21-E	25	25	490	65	672	1.0	.192	.185	.008	.042	3.5
5	22-E	25	25	501	63	604	0	.030	.028	.001	.033	20.1
10	23-E*	100	100	1915	112	2276	2.3	.340	.296	.050	.147	6.7
17	24-E*	-	-	533	93	734	1.8	.331	.286	.048	.145	2.2
19	25-E	25	25	514	147	808	-	.011	.010	.001	.091	73.4
22	26-E*	25	25	538	113	848	0.5	.102	.094	.011	.108	8.3
23	27-E	25	25	451	36	607	0.5	.106	.096	.013	.123	5.7
24	28-E	25	25	493	97	698	1.2	.203	.182	.024	.118	3.4
25	29-E	25	25	567	54	645	1.9	.342	.292	.052	.152	1.9
26	30-E	25	25	588	97	744	1.88	.342	.301	.042	.123	2.2
29	31-E*	25	25	446	129	599	1.78	.322	.248	.074	.230	1.9
31	32-E	25	25	535	119	682	1.5	.276	.247	.034	.123	2.5
Nov 5	33-E*	-	-	-	88	-	-	.323	.276	.048	.149	-
6	34-E	25	25	520	72	627	0.45	.106	.098	.011	.104	5.8
7	35-E	25	25	533	77	672	1.0	.205	.182	.028	.137	3.3
8	36-E	25	25	541	11	581	1.25	.229	.197	.036	.157	2.5
9	37-E	25	25	561	58	773	0	.030	.026	.005	.167	25.8
13	38-E*	25	25	450	73*	626	1.28	.238	.221	.018	.076	2.6
14	39-E	35	35	607	38	744	1.28	.229	.184	.049	.214	3.2
15	40-E	35	35	634	46	715	0.26	.062	.061	.004	.064	11.5
27	41-E*	35	35	579	33	659	0.19	.060	.059	.001	.017	11.0
29	42-E	17	17	281	11	353	0.22	.062	.062	.001	.016	5.7

*See Comments, Table 6

- No data

† Total non-CH₄ HC

(continued)

Table 4. (continued)

1	2	3		4	5	6	7	8				9
Date	Surro. Run No.	Injected Surrogate (ml)		Observed Surrogate HC T=0 (ppbC)	H ₂ CO T=0 (ppb)	Total Non-CH ₄ HC T=0 (ppbC)	Injected NO _x (ml)	Observed Oxides of Nitrogen T=0 (ppm)				HC/NO _x T=0
		Gas	Liq.					NO _x	NO	NO ₂	NO ₂ /NO _x	
Nov 30	43-E	17	17	331	17	402	0.57	.126	.120	.010	.079	3.2
Dec 3	44-E	17	17	332	28	436	0	.037	.037	.001	.027	11.8
13	45-E	-	-	349	57	433	-	.150*	.133	.017	.113	2.9
18	46-E	0	0	-	7	78	0.35	.060	.055	.005	.083	1.3
19	47-E	17	17	328	11	370	0	.012	.010	.002	.167	30.8
20	48-E*	17	17	313	0	350	0.5	.077	.074	.002	.026	4.5
<u>1974</u>												
Apr 3	49-G	90	122	2470	45	2592	2.0	.319	.266	.053	.166	8.1
4	50-G	70	95	1960	50	2088	2.1	.337	.298	.040	.119	6.2
5	51-G	23.5	32	640	65	802	0.325	.061	.056	.005	.082	13.1
8	52-G	44	59	1170	143	1450	2.1	.340	.310	.034	.100	4.3
10	53-G	44	59	1180	124	1348	2.9	.056	.049	.007	.125	24.1
11	54-G	70	95	2150	71	2380	0.265	.055	.047	.008	.145	43.3
15	55-G*	44	59	1140	56	1357	0	.016	.102	.005	.312	84.8
16	56-G	70	95	1930	43	2086	0.195	.046	.038	.008	.174	45.3
16	57-G	70	95	1910	75	2147	0.194	.044	.030	.014	.318	48.8
17	58-G	70	95	1900	83	2169	0.117	.038	.029	.010	.263	57.1
17	59-G	70	95	1890	75	2174	0.098	.032	.024	.008	.250	67.9
18	60-G	18.5	25.1	500	51	618	0.217	.046	.038	.007	.152	13.4
18	61-G	18.5	25.1	500	78	740	0.252	.059	.049	.008	.136	12.5
22	62-G*	18.5	25.1	500	69	746	0.518	.096	.071	.025	.260	10.5
23	63-G	90	122	2400	40	2625	0.240	.058	.042	.016	.276	45.2
23	64-G	44	59	1180	51	1330	0.482	.096	.080	.016	.167	13.9
24	65-G	44	59	1064*	56	1152*	0.149	.037	.028	.010	.270	31.1*
24	66-G	18.5	25.1	490	217	759	0.134	.038	.029	.008	.211	20.0
25	67-G	44	59	1161	54	1274	0.085	.030	.022	.007	.233	42.5
25	68-G	18.5	25.1	510	51	623	0.076	.031	.023	.007	.226	20.1
26	69-G	12	16.1	330	78	554	0.102	.031	.024	.007	.226	17.9
May 8	70-H*	90	150	-	53	2344	-2.0	.323	.277	.044	.136	7.3
10	71-H*	90	150	-	84	2454	1.86	.313	.270	.043	.137	7.8
15	72-G	44	59	1160	75	1301	1.44	.222	.196	.028	.126	5.9
16	73-G	12	16.1	360	66	497	0.558	.101	.080	.020	.198	4.9

* See Comments, Table 6

- No data

† Total non-CH₄ HC

Table 5. Experimental Conditions for Surrogate Runs 10 through 73

1	2	10	11		12	13		14				15	
Date	Surf. Run No.	Injected CH ₄ (ml)	Observed CH ₄ (ppb)		Injected CO (ml)	Observed CO (ppm)		Relative Humidity (%)				Temperature (°C)	
			T=0	T=6 hr T=0		T=0	T=6 hr T=0	RH	Temp	RH	Temp	T=0	T=6 hr
<u>1973</u>													
Jul 9	10-C*	9.4	2560	.918	45	4.9	.98	75	23.94*	-	-	24.24*	33.25*
10	11-C	10	2320	.966	45	4.9	.98	75	23.55	-	-	24.11	33.32
11	12-C	10	2420	1.00	45	5.0	.94	70	23.97	25	25.47	23.97	33.26
12	13-C	12	2640	1.00	45	4.9	.95	71	23.09	-	-	23.55	32.94
16	15-C*	12	2610	1.00	45	5.0	.94	75	22.72	-	-	22.86	32.18
17	16-C	13	2660	.98	45	5.1	.92	72	-	-	-	23.17	32.60
18	17-C	12	2690	.98	45	5.1	.94	70	23.5	-	-	23.17	32.67
19	18-C	-	2750	.95	-	5.1	.96	72	-	-	-	22.50	32.44
Oct 2	19-E	10	1920	1.00	45	5.2	.96	85*	22.97	-40*	-	23.00	30.87
3	20-E	10	1730	1.00	45	4.4	1.00	73	23.21	55	30.8	23.20	31.65
4	21-E	10	1885	1.01	45	5.0	1.00	64	23.25	-44	-	23.35	33.50
5	22-E	10	1600*	1.04	45	5.7	.91	56	22.86	32	-	22.86	31.19
10	23-E*	10	1440	1.00	45	4.6	.91	50	30.10*	-	-	29.83	31.10*
17	24-E*	10	2240	.978	30	3.7	.86	50	31.20*	45	30.90	31.27	33.10
19	25-E	7	1730	1.00	4.6	.8	1.12	50	32.00	34	32.95	32.00	32.00
22	26-E*	3.5	1700	.988	0	1.6	1.06	52	31.11	35	31.41	30.85	31.41
23	27-E	9.1	1680	1.01	3.8	1.6	.88	51	30.45	35	31.00	31.25	31.54
24	28-E	7.7	1870	1.00	0	1.3	0.92	50	30.81	35	31.40	31.28	31.40
25	29-E	6.65	1920	1.00	0	1.8	0.89	51	31.55	41	31.42	31.59	31.34
26	30-E	6.6	1730	1.01	0	1.8	.89	50	31.41	-	-	31.63	31.48
29	31-E*	7	1730	1.01	14	1.4	1.00	51	31.25	31	31.64	31.68	31.80
31	32-E	7.7	1780	.97	7.7	1.3	1.00	48	31.46	-	-	31.52	31.72
Nov 5	33-E*	-	-	-	-	-	-	49	31.39	-	-	31.87	31.71
6	34-E	7	1730	.98	0	1.8	1.00	51	31.20	32	30.80	31.90	31.69
7	35-E	5.6	1700	1.00	0	2.3	1.00	48	31.80	36	31.30	31.82	31.76
8	36-E	5.85	1685	1.01	0	2.2	1.00	48	31.40	37	31.85	31.96	31.85
9	37-E	5.75	1740	1.06	0	2.8	1.07	48	31.50	39	31.81	31.62	31.54
13	38-E*	7.9	1660	1.02	4.5	1.1	1.00	50	31.67	39	31.41	31.61	31.41
14	39-E	8.4	1740	1.02	5.8	.8	1.12	50	31.68	37	31.58	31.81	31.58
15	40-E	6.3	1700	1.02	0	1.2	.92	49	31.51	36	31.61	31.43	31.61
27	41-E*	8.0	1680	1.01	0	1.9	.95	50	31.31	52	25.9	31.62	31.40
29	42-E	7.0	1600	1.02	0	1.2	.92	50	31.12	33	32.21	21.62	31.58

* See Comments, Table 6

- No data

(continued)

Table 5. (continued)

1	2	10	11		12	13		14				15	
Date	Surr. Run No.	Injected CH ₄ (ml)	Observed CH ₄ (ppb)		Injected CO (ml)	Observed CO (ppm)		Relative Humidity (%)				Temperature (°C)	
			T=0	T=6 hr T=0		T=0	T=6 hr T=0	Initial	Final				
			RH	Temp		RH	Temp	T=0	T=6 hr				
Nov 30	43-E	7.6	1665	1.00	0	1.3	1.00	48	31.04	-	-	31.71	31.58
Dec 3	44-E	8.0	1760	.97	0	.4	1.25	51	31.81	47*	28.5	31.76	31.76
13	45-E	-	1600	1.02	-	2.2	.95	50	31.52	33	30.76	32.06	31.93
18	46-E	6.65	1550	.88	0	.4	1.25*	67	29.84	-	-	31.61	31.38
19	47-E	7.0	1790	1.00	4.3	.8	1.00	58	31.35	-	-	31.43	31.75
20	48-E*	6.3	1630	.98	3.3	.6	1.10	51	31.43	39	30.67	31.55	31.88
<u>1974</u>													
Apr 3	49-G	16	2910	0.89	48.0	9.1*	-	49	30.20	31	31.60	30.64	31.60
4	50-G	15.1	2820	0.86	39.0	7.1	0.80	48	30.96	31	31.95	31.81	31.95
5	51-G	7.2	1750	0.97	8.6	2.0	0.95	50	31.46	35	32.57	31.46	32.57
8	52-G	8.8	2080	0.98	8.6	3.8	0.92	48	30.64	37	32.81	30.64	32.81
10	53-G	9.6	2080	0.92	19.0	3.5	0.90	43	31.53	28	32.37	31.53	32.37
11	54-G	15.3	2830	0.94	38.0	7.4	0.89	46	31.47	28	31.58	31.47	31.58
15	55-G*	10.2	2080	0.96	18.6	3.5	0.80	44	31.58	27	32.28	31.58	32.28
16	56-G	10.1	2100	-	33.0	7.7	-	49	31.84	-	-	31.82	-
16	57-G	9.5	2080	-	38.5	7.4	-	50	32.20	-	-	31.14	-
17	58-G	15.0	2860	-	33.0	7.3	-	52	31.39	-	-	31.32	-
17	59-G	13.1	2820	-	34.2	6.6	-	50	31.69	-	-	31.93	-
18	60-G	8.4	1730	-	9.0	1.6	-	50	31.93	-	-	32.12	-
18	61-G	7.5	1730	-	13.5	2.4	-	52	33.18	-	-	31.98	-
22	62-G*	7.5	1700	1.02	8.0	2.1	1.00	50	32.73	34	32.04	32.25	32.04
23	63-G	14.7	2670	-	33.0	7.2	-	52	31.62	-	-	31.89	-
23	64-G	10.8	2100	-	20.5	3.7	-	57	32.00	-	-	31.60	-
24	65-G	(11.7)*	500	-	20.0	3.7	-	50	31.56	-	-	31.65	-
24	66-G	7.8	1700	-	10.2	1.8	-	50	30.95	-	-	31.37	-
25	67-G	11.0	2020	-	16.4	3.9	-	50	30.95	-	-	30.86	-
25	68-G	7.8	1700	-	10.7	1.8	-	51	31.62	-	-	31.62	-
26	69-G	7.2	1520	1.04	4.6	1.2	1.00	50	30.03	39	31.10	30.03	31.11
May 8	70-H*	13.9	2690	-	29.0	6.8	-	55	31.64	-	-	31.62	-
10	71-H*	14.0	2880	-	33.3	7.1	-	48	31.70	-	-	31.84	-
15	72-G	10.4	2100	0.98	18.3	3.8	0.95	51	30.78	34	30.90	30.78	30.90
16	73-G	7.2	1570	1.04	5.8	1.2	1.08	51	31.02	32	30.92	31.02	30.92

* See Comments, Table 6

- No data

Table 6. Comments for Tables 4 and 5

Date	Surr. Run No.	Comments
<u>1973</u>		
Jul 9	10-C	O ₃ conditioning July 6-9, pure air flush only morning of July 9. All temperatures are Wall T (thermometer taped to outside surface of chamber).
10	11-C	No aromatics or oxygenates measured, estimate included.
11	12-C	Aromatics and oxygenates estimated, HC corrected for calibration error.
12	13-C	Aromatics and oxygenates estimated, HC corrected for calibration error.
16	15-C	O ₃ conditioning July 13-15, pure air flush 1.5 hr on July 15. Aromatics and oxygenates estimated. HC corrected for calibration error.
17	16-C	
18	17-C	Aromatics and oxygenates estimated.
19	18-C	
Oct 2	19-E	Brady array used to measure RH from here on. Aromatics and oxygenates estimated.
3	20-E	
4	21-E	
5	22-E	CH ₄ at T=0.5 hr.
10	23-E	Sonic pumps on 9 min into run. IR lamps installed and chamber opened to place thermometer inside (Sample T) on Oct. 8.
17	24-E	O ₃ conditioning Oct. 12-15, pure air flush 3 hr on Oct. 15. Temperature range reported 31.05-31.21°.
19	25-E	
22	26-E	For flush Oct. 19 Hopcalite and charcoal filters not on. RH air pump on 205 min into run, 2.6 l/min=533 l.
23	27-E	
24	28-E	
25	29-E	
26	30-E	
29	31-E	7.5 hour run.
31	32-E	
Nov 5	33-E	O ₃ conditioning Nov 2-4, pure air flush 15 hr (overnight) on Nov. 4 No gc analyses. No data sheets.
6	34-E	
7	35-E	
8	36-E	
9	37-E	
13	38-E	Coconut charcoal changed Nov. 12, H ₂ CO at T=2 hr.
14	39-E	
15	40-E	
27	41-E	O ₃ conditioning Nov. 21-26, pure air flush 2 hr on Nov. 26. Dummy surrogate run on Nov. 26.
29	42-E	

(continued)

Table 6. (continued)

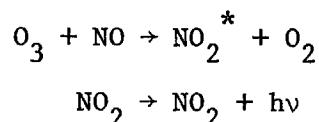
Date	Surr. Run No.	Comments
Nov 30	43-E	
Dec 3	44-E	RH read ~30 min after end of run.
13	45-E	TECO used to monitor NO _x from here on, flow 895 ml/min.
18	46-E	CO (T=6 hr) is 5.5 hr value.
19	47-E	
20	48-E	10 hour run.
<u>1974</u>		
Apr 3	49-G	CO at 1.5 hours.
4	50-G	
5	51-G	
8	52-G	
10	53-G	
11	54-G	
15	55-G	9-hour run.
16	56-G	
16	57-G	
17	58-G	
17	59-G	
18	60-G	
18	61-G	
22	62-G	8.5-hour run.
23	63-G	
23	64-G	
24	65-G	C ₂ H ₆ (~1600 ppb) added instead of CH ₄ ; not included in HC totals.
24	66-G	
25	67-G	
25	68-G	
26	69-G	
May 8	70-H	Special aromatics surrogate.
10	71-H	Special aromatics surrogate.
15	72-G	
16	73-G	

these experiments: 6-hour (maximum) concentration, dosage and time for which a given concentration was exceeded (based on a 6-hour run). Values of these reactivity parameters for O_3 , PAN and NO_2 are summarized in Table 7 for 42 selected runs. Several runs were not included because very low initial NO_x/NO_2 ratio concentrations led to low ozone levels. A few runs were excluded due to inaccuracies associated with the measurement of very low initial NO_x concentrations using the Bendix chemiluminescent instrument or due to the excessive ozone production observed in the first run after an ozone conditioning of the chamber.

C. Special Studies of Analytical Methods and Instruments

1. Response of Commercial Chemiluminescent NO- NO_2 Analyzers to Other Nitrogen-Containing Compounds

Introduction. Atmospheric concentrations of nitric oxide (NO) and nitrogen dioxide (NO_2) are now routinely measured by instruments employing the gas phase chemiluminescent reaction of ozone with nitric oxide:



The light emitted by the electronically excited NO_2 is monitored to obtain a quantitative measure of the NO concentration. Major advantages of this technique are high precision, selective response to NO, sensitivity in the part per billion range, linearity over a factor of 10^6 in concentration, and relatively short response times.³⁰⁻³³

In all recent commercial chemiluminescent analyzers, nitrogen dioxide is determined as nitric oxide after passage of the sample stream through a heated carbon, stainless steel, or molybdenum converter which quantitatively reduces NO_2 to NO. The total NO (i.e., the original NO plus the reduced NO_2) is then reacted with ozone, and the chemiluminescent emission recorded as total oxides of nitrogen (NO_x). Electronic subtraction of the NO signal from the NO_x signal yields the amount of NO_2 originally present in the sample.

Table 7. Initial Reactant Concentrations and Values of Reactivity Parameters for Surrogate Irradiations

Run No.	Initial Concentrations		Ozone ^a						Time above (min) ^c						PAN			NO _x ^b					
	Non-CH ₄ HC (ppbC)	NO _x (ppm)	Dosage (ppm × min)		>0.10 ppm		>0.08 ppm		0.10 ppm		0.15 ppm		0.20 ppm		0.25 ppm		6-hr (ppm)	Dosage (ppm × min)	Maximum (ppm)	Total	>0.25 ppm		
			Total	6-hr (ppm)	>0.10 ppm	>0.08 ppm	0.10 ppm	0.08 ppm	0.15 ppm	0.20 ppm	0.25 ppm	0.10 ppm	0.08 ppm	0.15 ppm	0.20 ppm	0.25 ppm							
49-G	2592	.319	.484	78.06	49.96	55.06	26.1	249	220	190	159	.036	4.18	.222	.222	60.88	0	.032	.301	84.73	7.11		
63-G	2625	.058	-	-	-	-	331	324	300	-	-	-	-	-	-	-	-	.304	.235	86.59	8.52		
11-C	1970	.434	.261	31.56	11.32	14.52	14.31	149	98	53	12	.012	1.99	.301	.301	84.73	7.11	-	-	-	-		
12-C	1981	.434	.263	31.16	11.14	14.31	14.1	141	95	51	10	.010	1.59	.301	.301	84.73	7.11	-	-	-	-		
23-E	2276	.340	.334	47.68	22.53	26.73	21.8	200	154	108	67	.015	2.29	.218	.218	58.96	0	.030 ^d	3.52 ^d	-	-		
50-G	2088	.337	.372	50.89	26.64	30.66	21.3	197	160	123	86	.027	5.08	.155	.155	38.45	0	.027	5.08	-	-		
13-C	2096	.200	.487	90.12	59.87	65.49	286	249	217	187	.021	5.62	.087	.087	20.13	0	.021	5.62	-	-	-	-	
2127	.114	.421	.882	66.33	72.49	315	309	289	263	229	.021	5.15	.073	.073	16.91	0	.021	5.15	-	-	-	-	
15-C	.098	.402	.962	63.39	69.69	318	312	291	264	229	.020	4.15	.039	.039	9.65	0	.020	4.15	-	-	-	-	
17-C	1959	.311	.77.00	43.80	50.25	323	317	289	241	161	.013	4.39	.033	.033	7.13	0	.013	4.39	-	-	-	-	
18-C	2026	.056	.311	77.11	43.55	50.00	327	321	298	252	157	.014	4.39	.033	.033	7.13	0	.014	4.39	-	-	-	-
54-G	2380	.035	.289	-	-	-	323	314	273	-	-	-	-	-	-	-	-	.026	-	-	-	-	
56-G	2086	.046	-	-	-	-	327	316	-	-	-	-	-	-	-	-	-	.021	-	-	-	-	
57-G	2147	.044	-	-	-	-	324	308	-	-	-	-	-	-	-	-	-	.014	-	-	-	-	
58-G	2169	.038	-	-	-	-	279	276	-	-	-	-	-	-	-	-	-	.014	-	-	-	-	
59-G	2174	.032	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.007	.082	.218	.218		
52-G	1450	.340	.173	18.94	3.02	4.87	1.06	81	30	-	-	-	-	-	-	-	.115	.008	1.15	.152	.44.53		
72-G	1301	.222	.324	49.57	23.55	28.05	22.9	210	162	115	76	.008	-	-	-	-	-	.035	8.07	0	-	-	
64-G	1310	.096	-	-	-	-	301	291	-	-	-	-	-	-	-	-	.019	-	-	-	-		
53-G	1348	.056	.305	78.77	45.55	51.95	321	288	247	178	.011	-	-	-	-	-	.013	.3.16 ^f	0	.208	.62.58		
65-G	1132 ^e	.037	-	-	-	-	318	298	-	-	-	-	-	-	-	-	.055	-	.007	.082	.218		
67-G	1274	.030	-	-	-	-	282	244	-	-	-	-	-	-	-	-	.003	.001	.001	.004	.206		
55-G	1357	.016	.120	21.10	0.60	2.49	125	60	-1.06	-	-	-	-	-	-	-	.001	.001	.001	.006	.198		
30-E	744	.342	.059	7.49	0	0	-	-	-	-	-	-	-	-	-	-	.001	.001	.001	.004	.206		
29-E	645	.072	.012	8.08	0	0	-	-	-	-	-	-	-	-	-	-	.001	.001	.001	.006	.198		
31-E	599	.322	.061	8.20	0	0	-	-	-	-	-	-	-	-	-	-	.001	.001	.001	.006	.198		
32-E	682	.276	.063	7.94	0	0	-	-	-	-	-	-	-	-	-	-	.001	.001	.001	.006	.198		
38-E	626	.238	.104	11.89	0.06	0.38	32	5	-	-	-	-	-	-	-	-	.002	.002	.002	.018	.143		
36-E	581	.229	.119	16.79	0.38	1.54	79	36	-	-	-	-	-	-	-	-	.003	.003	.003	.054	.143		
39-E	744	.229	.133	17.02	0.89	2.33	87	56	-	-	-	-	-	-	-	-	.003	.003	.003	.039	.130		
35-E	672	.205	.174	24.39	3.95	6.47	165	110	31	-	-	-	-	-	-	-	.003	.003	.003	.042	.134		
28-E	698	.203	.189	26.73	5.30	8.12	156	122	52	-	-	-	-	-	-	-	.048	.048	.048	.048	.168		
21-E	672	.192	.239	29.73	8.76	11.64	159	133	82	30	-	-	-	-	-	-	.004	.004	.004	.048	.168		
62-G	746	.096	.298	54.96	26.22	31.12	256	235	185	137	75	.008	.1.51	.057	.057	.15.77	0	.009	.1.51	.057	.15.77		
51-G	802	.061	.285	61.75	31.15	36.69	285	269	227	171	94	.009	.2.30	.039	.039	.10.18	0	.009	.2.30	.039	.10.18		
61-G	740	.059	-	-	-	-	282	265	-	-	-	-	-	-	-	-	.026	-	-	-	-		
60-G	618	.046	-	-	-	-	280	263	-	-	-	-	-	-	-	-	.016	-	-	-	-		
66-G	759	.038	-	-	-	-	290	267	-	-	-	-	-	-	-	-	.012	-	-	-	-		
68-G	623	.031	-	-	-	-	265	225	-	-	-	-	-	-	-	-	.012	-	-	-	-		
45-E	433	.150	.100	12.36	0	0.51	43	0	-	-	-	-	.003	.045	.045	.045	.059	.059	.059	.059	.059		
73-G	497	.101	.249	39.82	14.47	18.40	211	186	127	67	-	-	.003	.071	.071	.071	.062	.062	.062	.062	.062		
69-G	554	.031	.176	39.19	9.72	14.49	259	222	97	-	-	-	.003	.022	.022	.022	.022	.022	.022	.022	.022		
47-G	370	.012	.105	17.13	0.08	1.06	75	75	19	-	-	-	.002	.022	.022	.022	.022	.022	.022	.022	.022		

^a Ozone data were obtained with UV absorption instruments calibrated against 2% neutral buffered KI and are uncorrected

^b Corrected for 100% of PAN concentration

^c Based on 360 min run; values are obtained by linear interpolation

^d 330 min data

^e 1.6 ppm ethane (added instead of methane) not included

^f NO_x increased during run

Interference from any of the common air pollutants such as NO_2 , CO, hydrocarbons, NH_3 and SO_x are apparently negligible in the chemiluminescent detection of NO with ozone.³⁰⁻³² The same specificity, as well as the other advantages cited above for NO determination, is implied for the NO_2 determination by commercial instrument manufacturers. However, when the instruments are operated in the NO_x mode (i.e., passage of the gas stream through the converter), potential interferences include nitrogen-containing compounds which may be reduced to NO in the thermal converter, thereby causing anomalously high signals for NO_x and hence correspondingly high values for NO_2 .

The possibility of interferences in the determination of NO_2 when using chemiluminescent analyzers became of particular concern to us in the course of smog chamber studies in which higher-than-ambient levels of peroxyacetyl nitrate (PAN) were formed. Preliminary experiments did, in fact, lead to the observation that PAN was being read as NO_2 by the commercial chemiluminescent $\text{NO}-\text{NO}_2$ analyzers in our laboratory.³⁴ In view of our desire to obtain precise concentration-time profiles for NO_2 in these chamber experiments, it became of interest to determine whether other compounds such as organic nitrates, organic nitrites and nitrogenous acids also decompose on the converter to produce NO with resulting interferences in the determination of NO_2 .

Accordingly, we undertook an investigation²⁸ of the signal response characteristics of PAN, ethyl nitrate, ethyl nitrite, nitroethane and nitric acid resulting from passage of the appropriate gaseous stream through the molybdenum catalytic converter in the NO_x and NO_2 modes of a commercial chemiluminescent analyzer. In addition we obtained similar data for PAN and n-propyl nitrate for a chemiluminescent oxides of nitrogen analyzer employing a carbon converter.

Experimental. The chemiluminescent $\text{NO}-\text{NO}_2$ instruments employed were commercial instruments whose only modification was a reduction in sample flow rate to about 174 ml/min and 600 ml/min for the analyzers equipped with carbon and molybdenum converters, respectively. The lower flow rates were required to minimize volumes sampled during chamber experiments and did not affect the sensitivity, precision, or accuracy of measurement.

Peroxyacetyl nitrate was prepared according to the procedures of Stephens, Burleson and Cardiff.³⁵ The PAN concentration was determined from its infrared absorption band at 1163 cm⁻¹.³⁶

Ethyl nitrate, ethyl nitrite and nitroethane samples were individually prepared by accurately injecting the liquids into the evacuated LPO tanks with microliter syringes and then pressurizing the tanks with prepurified nitrogen.

NO from a standard cylinder was injected into an LPO tank and pressurized with prepurified nitrogen for use as a control sample. Gas-phase nitric acid (HNO_3) was prepared by bubbling prepurified N₂ through a solution of HNO₃ and diluting the resulting mixture with N₂ to the desired concentration.

The concentrated, pressurized gases were individually diluted in a nitrogen stream using a series of calibrated flow meters. After dilution through the consecutive flow meters, the gases were analyzed for signal response on the NO_x and NO₂ mode of the chemiluminescent analyzers (i.e., after passage through the converter).

Background signal response to the diluent nitrogen at the appropriate flow rates was measured on the NO_x, NO₂ and NO modes of the chemiluminescent analyzer and any necessary corrections were applied to the signal response observed for the nitrogen-containing compounds. Before all measurements, the chemiluminescent analyzers were calibrated with a standard calibration tank of NO, the concentration of which was further authenticated by analysis using the Saltzman method.

The efficiency for NO₂ to NO conversion for each instrument was checked by employing the gas phase titration of NO with O₃ to produce NO₂.³⁷ Specifically, as the NO sample stream was titrated with increasing amounts of ozone (up to equal parts O₃ to NO), the NO_x signal level was observed during the progressive titration, since all of the NO₂ produced was reconverted quantitatively to NO in the instrument. However, for efficiencies less than 100% the NO_x reading decreased during the titration since some NO₂ was not being read (i.e., converted to NO) by the instrument. During this study the molybdenum converter efficiency was 100 \pm 2%, while that for the carbon converter was 95 \pm 3% over the concentration range studied.

Results and Discussion. Most of our studies were carried out on the NO-NO₂ analyzer equipped with a molybdenum converter since it had 10 times more sensitivity and demonstrated a more rapid converter response.

Figure 4 shows the response observed for an NO sample stream. The 2% difference between the observed NO response (solid line) and the calculated NO concentrations (dashed line) is taken as a measure of the experimental uncertainties in the sample preparation and dilution flow procedures employed.

The solid line in Figure 5 is a least squares fit of the observed response of the molybdenum converter instrument vs. the corresponding concentrations of PAN in the diluted sample stream. Identical data were obtained from both the NO₂ and NO_x modes since there was no NO present in the sample stream. The dashed line in Figure 5 again corresponds to a 100% instrument response.

The least squares analysis of the data in Figure 5 shows that for this commercial instrument, PAN is reduced to NO during passage over the molybdenum converter with an efficiency of 92% as shown by the concomitant signal response in either the NO_x or NO₂ mode. The response is linear in the concentration range from 0-400 ppb, with a linear correlation coefficient of 0.99.

The PAN study was repeated for the carbon converter chemiluminescent analyzer. Whereas in the case of the molybdenum converter, the response to PAN was essentially instantaneous, for the carbon converter the response to PAN increased gradually with time to a maximum value. This behavior was observed for both nitrogen- and air-diluted sample streams. The least squares fit of response of the carbon converter analyzer to PAN (Figure 6) yielded an efficiency of NO production, and hence measurement as NO₂, of 98% with a standard deviation of $\pm 3\%$. Results from the reference experiment, using NO to determine uncertainty introduced in the experimental procedure, are shown for the carbon converter instrument in Figure 7 and correspond to a difference between observed and calculated values of 5-10% over the concentration range studied. Thus, within the experimental uncertainty and except for the difference in time to reach maximum response, the same quantitative

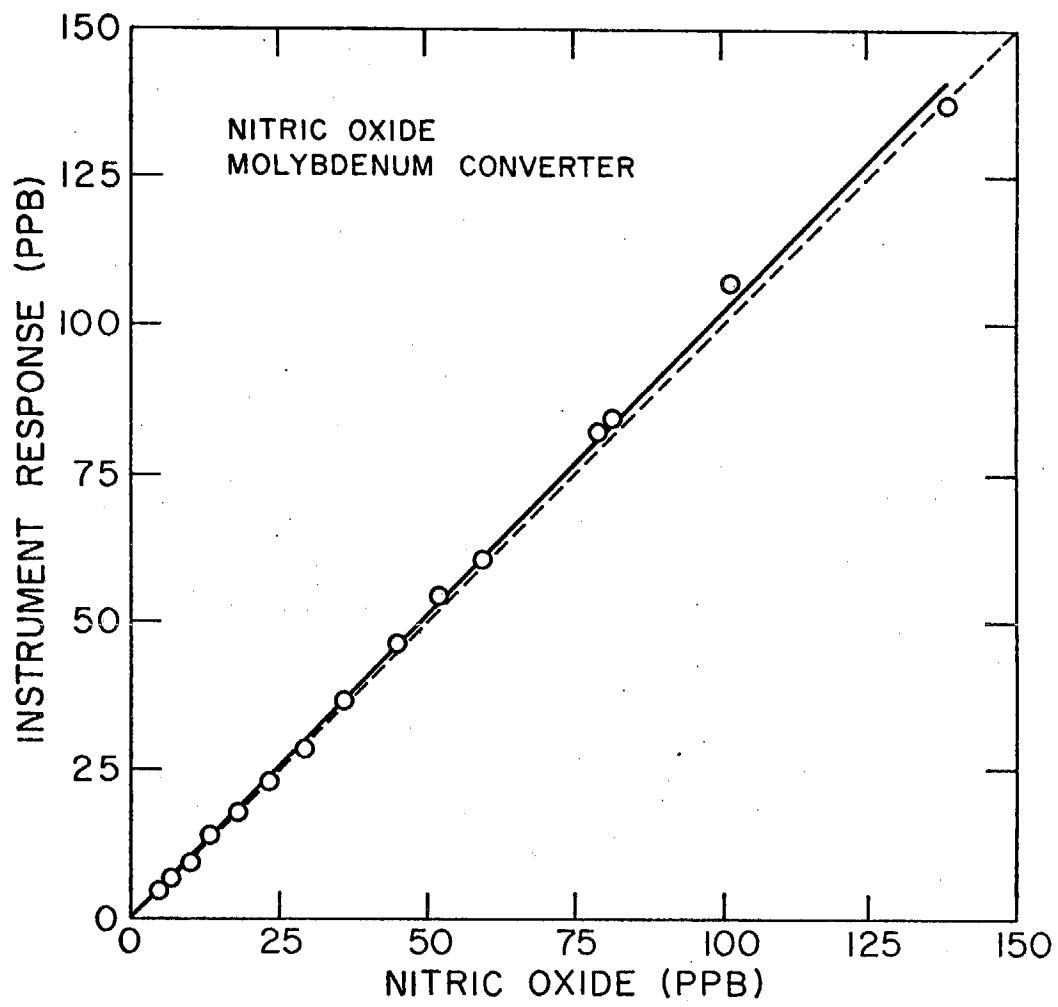


Figure 4. Response to Nitric Oxide for NO (and NO_x) Modes With Molybdenum Converter

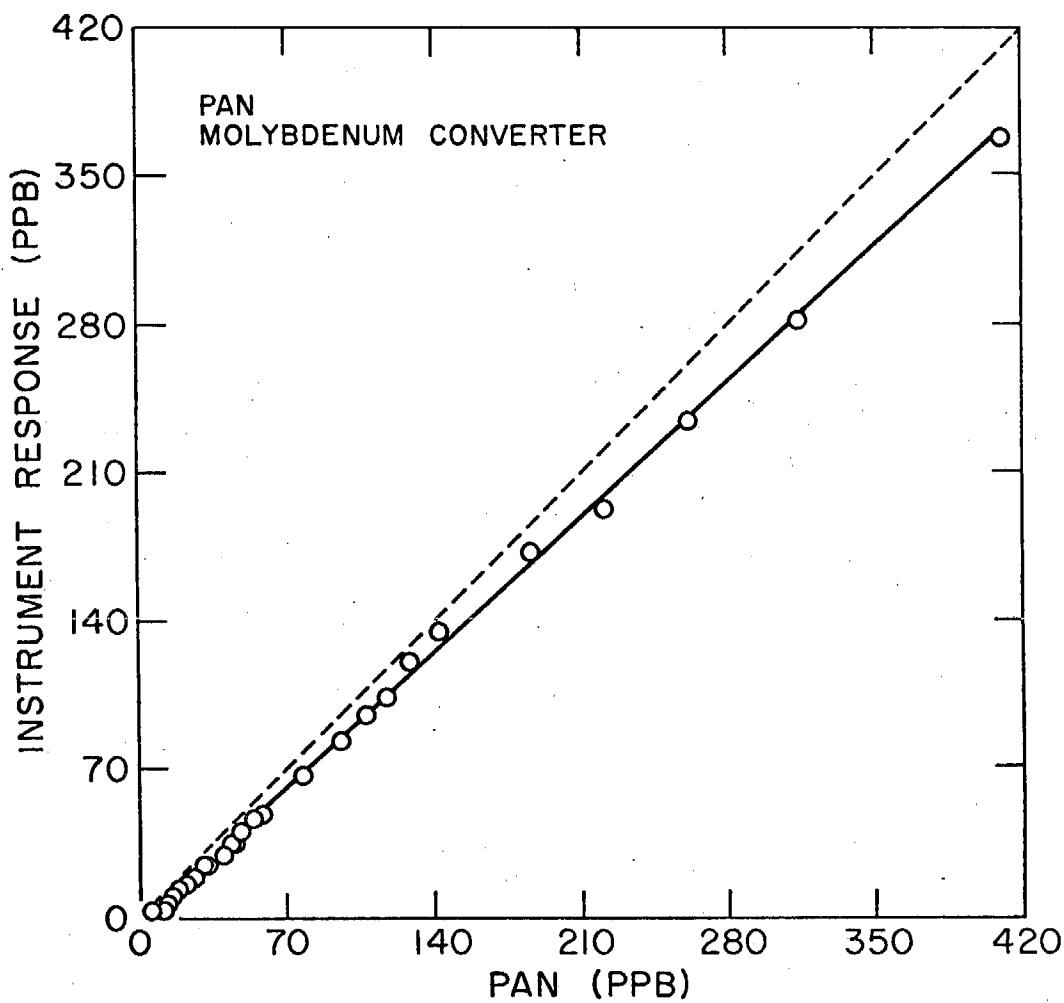


Figure 5. Response to PAN for NO_2 (and NO_x) Modes With Molybdenum Converter

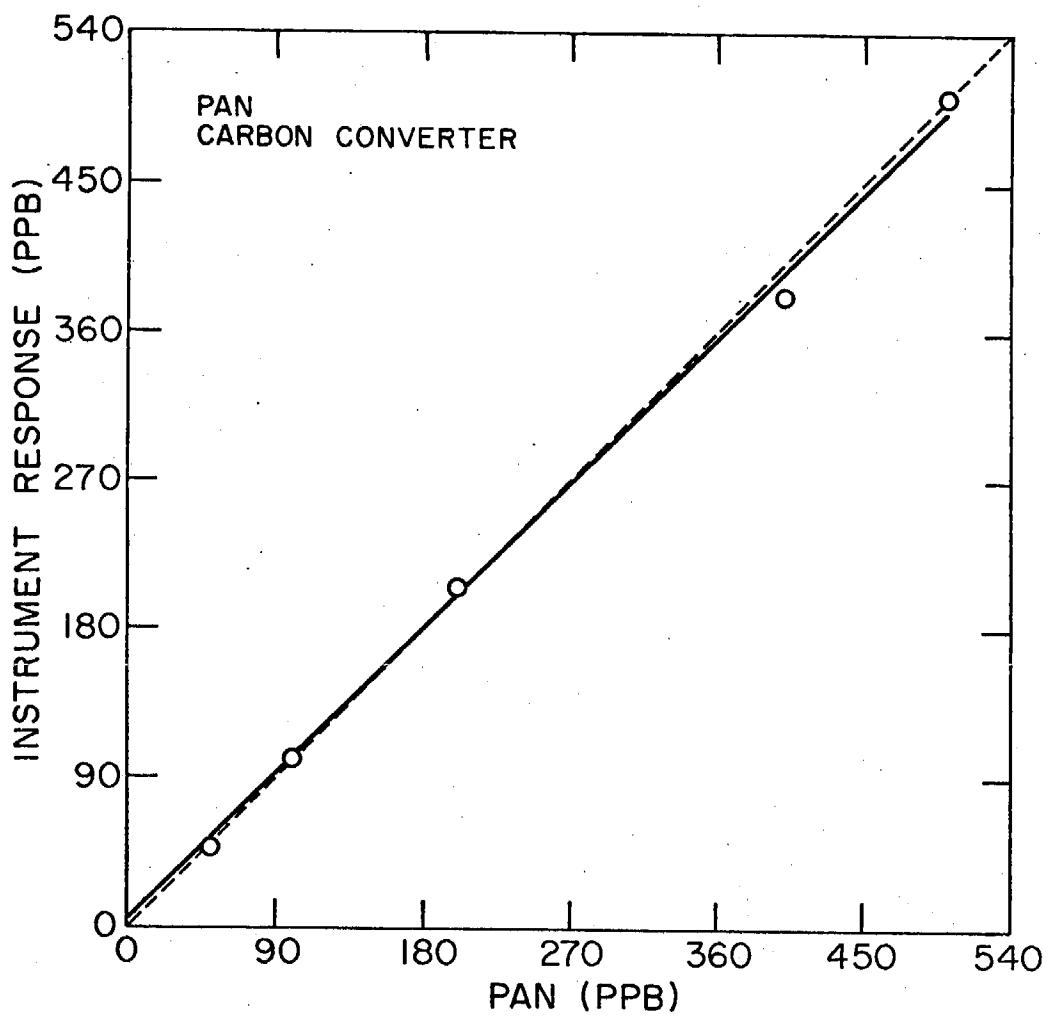


Figure 6. Response to PAN for NO_2 (and NO_x) Modes With Carbon Converter

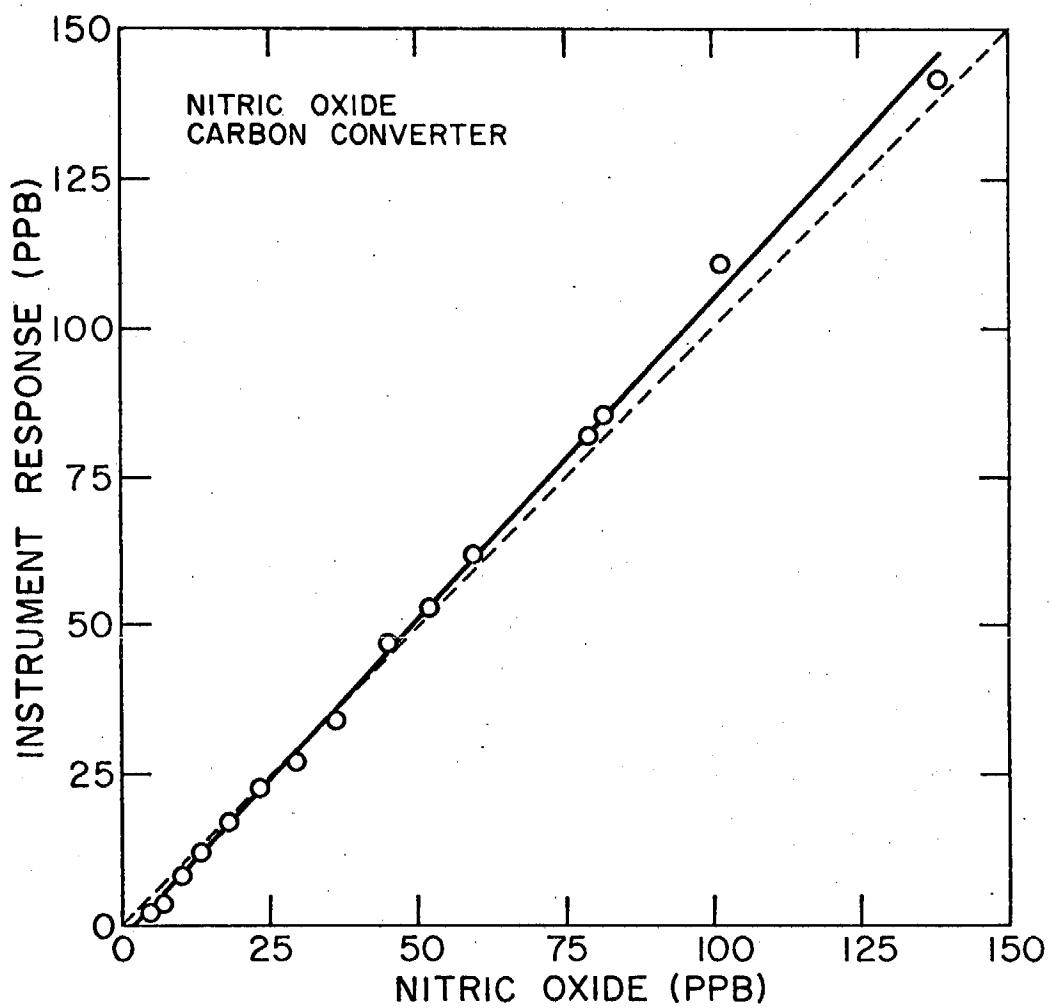


Figure 7. Response to Nitric Oxide for NO (and NO_x) Modes With Carbon Converter

conversion of PAN is observed for both the molybdenum and carbon converters. A summary of the data for the two types of converters is given in Table 8.

The response of the molybdenum converter NO- NO_2 analyzer to ethyl nitrate and ethyl nitrite is shown in Figures 8 and 9, respectively, and the results are summarized in Table 8. Within an experimental uncertainty of approximately 5%, a 100% linear response is observed in the NO_2 mode of the analyzer for these compounds over a wide range of concentration.

In contrast to these results and those for PAN, an examination of nitroethane (Figure 10) produced a signal response of only 6-7% of the nominal nitroethane concentration in the sample stream.

In a single determination of the response of the carbon converter analyzer to n-propyl nitrate, a signal equal to 92% of the nominal n-propyl nitrate concentration was observed. Thus, within experimental uncertainty, the conversion of this nitrate to NO on the carbon catalyst appears to be essentially quantitative.

Conclusions. The implications of these observations are not serious in the case of most ambient air analyzes, where concentrations of PAN seldom rise above 40 ppb, and the concentrations of organic nitrates and nitrites and nitric acid are expected to be somewhat lower (0-10 ppb). However, for highly quantitative ambient air studies, under circumstances where relatively low concentrations of NO_2 occur simultaneously with high concentrations of PAN and other nitrogen-containing compounds, corrections for interference by these compounds in NO_2 determinations by the chemiluminescence method may be non-negligible. In the case of smog chamber experiments in which higher-than-ambient concentrations of PAN and nitrates are often produced and very accurate data are required, for example for modeling studies, it will be necessary to determine independently the concentrations of interfering species by gas chromatography, infrared spectroscopy, or other methods and to then apply quantitative corrections to the chemiluminescent NO_2 determinations. Clearly, in the absence of corrections for interferences, the data obtained in many smog chamber experiments using the NO_x mode of commercial chemiluminescent analyzers must be

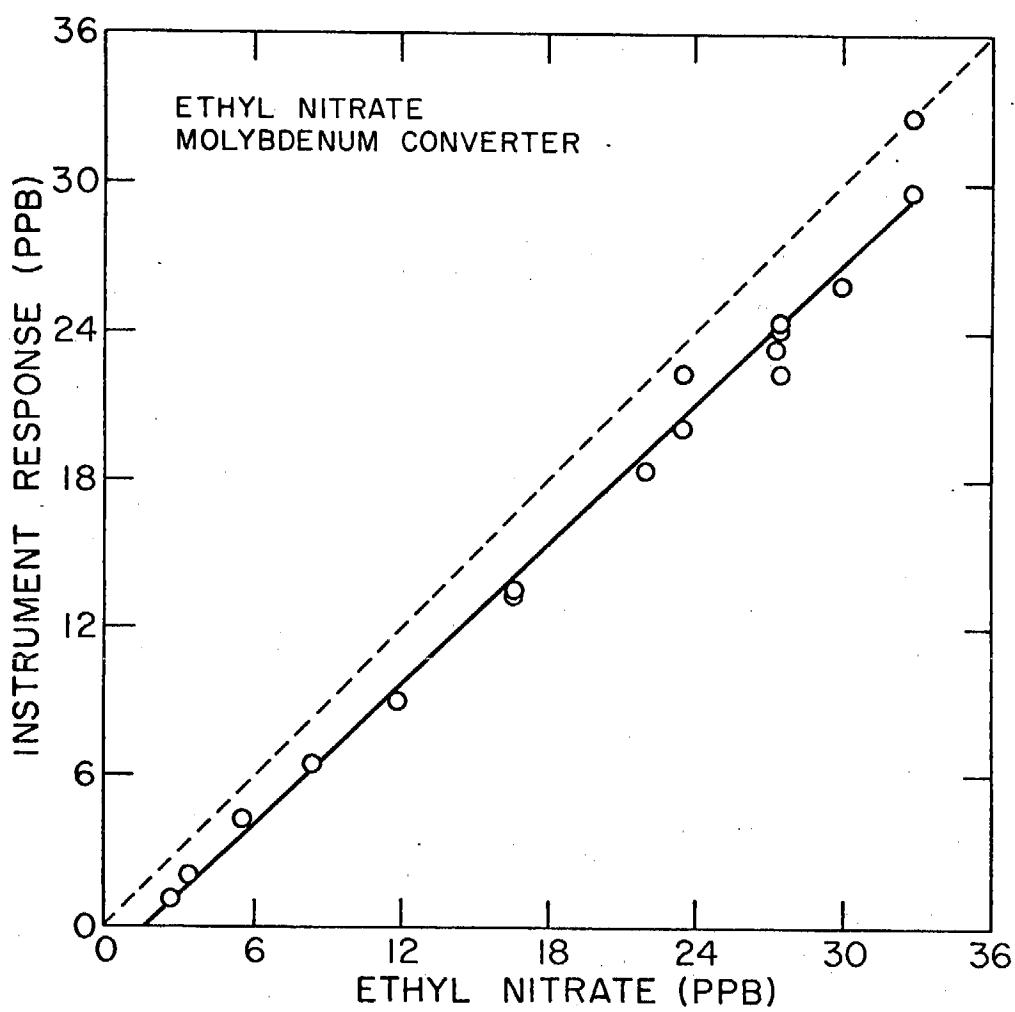


Figure 8. Response to Ethyl Nitrate for NO_2 (and NO_x) Modes With Molybdenum Converter

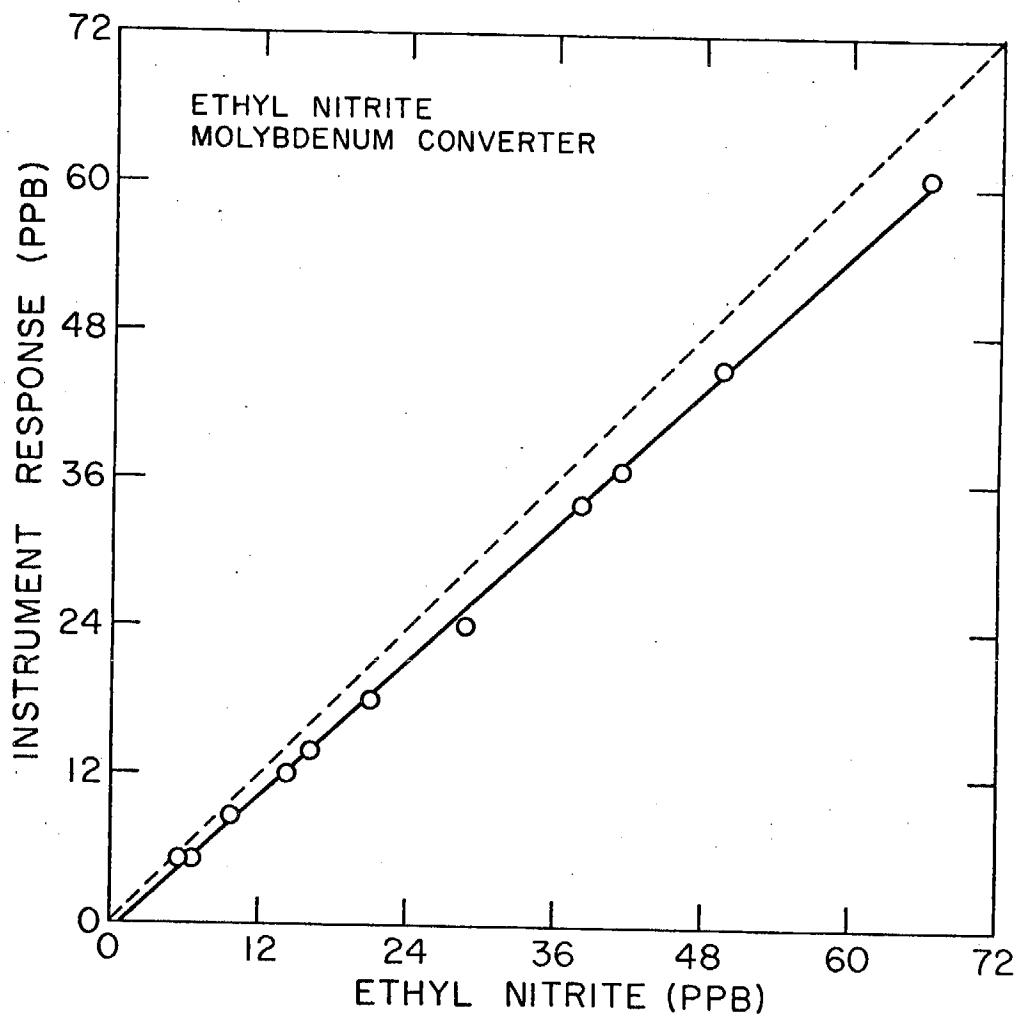


Figure 9. Response to Ethyl Nitrite for NO_2 (and NO_x) Modes With Molybdenum Converter

Table 8. Response of Two Commercial Chemiluminescent NO-NO₂-NO_x Analyzers to Nitrogen-Containing Compounds in the NO₂ and NO_x Modes

Compound	Converter ^a	Response ^b (%)	Standard Deviation (%)	Linear Correlation Coefficient	Range of Concentration (ppb)
Peroxyacetyl nitrate	M	92	1.0	1.00	0-410
Nitric oxide ^c	M	102	1.0	1.00	0-140
Peroxyacetyl nitrate	C	98	3.0	1.00	0-500
Nitric oxide ^c	C	100	1.0	1.00	0-145
Ethyl nitrate	M	103	6.0	0.99	0-355
Ethyl nitrite	M	92	1.0	1.00	0-66
Nitroethane ^d	M	6	0.4	0.96	0-340
Nitroethane ^e	M	7	0.3	1.00	0-240
n-Propyl nitrate	C	92 ^f

^a M = Molybdenum; C = Carbon

^b Least squares analysis over indicated range of concentration.

^c Measured in the NO_x mode with no NO₂ in the sample stream, i.e., NO = NO_x.

^d Air diluent.

^e N₂ diluent.

^f Determined for a single concentration.

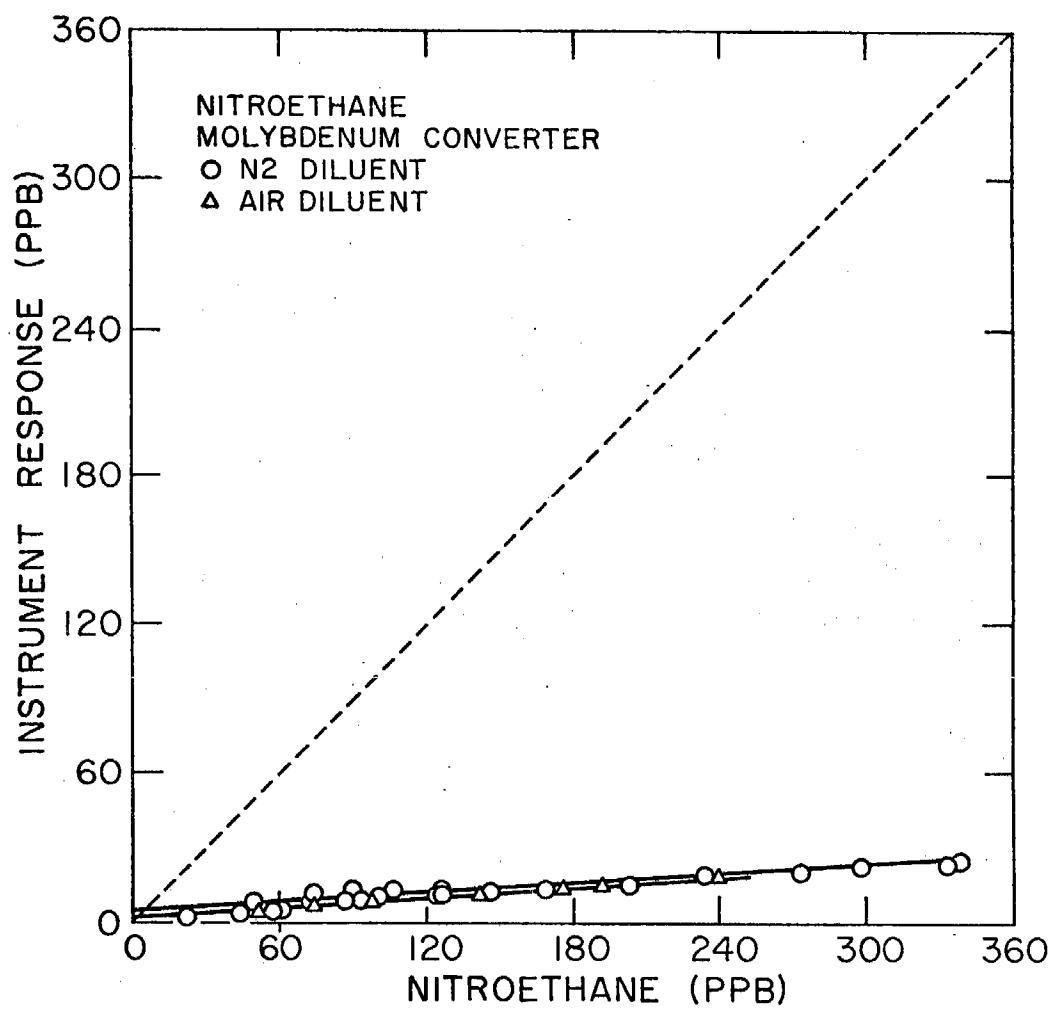


Figure 10. Response to Nitroethane for NO₂ (and NO_x) Modes With Molybdenum Converter

viewed as more nearly equal to total gas phase oxides of nitrogen measurement, not simply the sum of NO and NO₂.

As a result of this investigation, all NO₂ and NO_x data given in this Final Report have been corrected for PAN, which was independently measured by electron capture gas chromatography. Concentrations of organic nitrites and nitrates (< a few ppb) observed in the surrogate experiments are considered negligible compared to NO₂ and NO_x concentrations and corrections have not been applied for these compounds.

2. Discrepancies Between Buffered and Unbuffered Potassium Iodide Methods for the Calibration of Ambient Oxidant Meters

In June 1974, just prior to the end of this contract period, it was revealed by the California Air Resources Board^{38,39} that a systematic and significant (35%) discrepancy exists between the ozone calibration procedures employed by the Los Angeles County Air Pollution Control District (LAAPCD) and the methods used by other California counties' APCD's, the ARB and the EPA. While the LAAPCD utilizes 2% unbuffered potassium iodide (KI) absorbing solutions and a visual end-point titration for calibration,⁴⁰ the other agencies employ a colorimetric determination for 1% (EPA) or 2% (ARB) neutral buffered KI absorbing solutions in their calibration procedure.⁴¹⁻⁴³ The revelation that oxidant measurements made by the LAAPCD are approximately 35% lower^{38,39} than equivalent measurements made by other agencies in the South Coast Air Basin, has caused substantial difficulties for control officials concerned with the establishment of basin-wide health warning alert systems and the implementation of oxidant control strategies, as well as for atmospheric scientists attempting to develop models describing pollutant transport in the California South Coast Air Basin.

Additional ramifications of the reported discrepancy in oxidant measurement methods concern the validity and consistency of (a) oxidant and ozone measurements made in studies upon which the federal air quality standard and "significant harm" and "emergency action levels" for oxidant were based,⁴⁴ and (b) measurements utilized in development of the implementation plans for oxidant control in the South Coast Air Basin.⁴⁵

An immediate impact of the reported discrepancy concerns the absolute accuracy of the ozone concentration obtained in the investigations described in this Final Report. All of the ozone analyses employed in these studies have been calibrated either by ARB or SAPRC personnel using the ARB 2% neutral buffered KI method. At the close of this contract period the SAPRC is undertaking an investigation of the 2% neutral buffered KI method at ambient concentrations using long-path infrared (LPIR) spectroscopy.⁴⁶ Other studies are being initiated by the ARB and EPA. A complete report of the results obtained in the SAPRC investigation will be given in the Final Report for Contract 4-214. At the time of preparation of the current Report, a definitive reconciliation of the ozone calibration procedure discrepancy has not been made. Therefore, unless specifically noted otherwise, all ozone data given in this Report are as read directly from instruments calibrated against 2% neutral buffered potassium iodide, and are not corrected in any way.

IV. DISCUSSION

Evaluation of the chamber data and their use in determining the effects of various control strategies for HC and NO_x on photochemical oxidant formation forms the basis for the following discussions.

Section A describes the application of data for the time required for ozone to reach 0.1 ppm in chamber irradiation to the prediction of the ambient levels of NO_x and non-methane hydrocarbons (NMHC) necessary to achieve the California air quality standard for oxidant (0.1 ppm hourly average).

Section B utilizes the 6-hour ozone concentrations (which are maxima for all 6-hour chamber runs) in evaluating the predicted effect on maximum ozone levels resulting from various incremental reductions in NMHC and NO_x ambient levels.

In Section C a mathematical treatment of the chamber data to obtain smoothed 6-hour ozone dosage contours is given.

Section D presents a preliminary statistical analysis of ambient air monitoring data which will ultimately provide the basis for relating the chamber data to estimates of the frequency of occurrence of high oxidant days in future atmospheres in the SCAB.

Section E discusses the results of chamber experiments carried out with a surrogate mixture rich in aromatic hydrocarbons and illustrates the usefulness of these experiments in determining the relative reactivity of various hydrocarbons under ambient conditions.

A. Preliminary Interpretation of the Chamber Data in Terms of Implications for Achieving the California Ambient Air Quality Standard for Oxidants

State and Federal ambient air quality standards for oxidants,⁴⁷ and subsequent implementation plans for their achievement,⁴⁸ have been the focus of intense discussion and even controversy by many involved segments of our society,⁴⁹⁻⁵¹ including control officials, atmospheric scientists, auto manufacturers, health officials, etc. Nowhere have the issues been more intensely debated than in the oxidant-plagued South Coast Air Basin of California (SCAB). Yet, despite extensive studies of the photochemical smog problem in the SCAB by a variety of groups, no universally accepted

data⁵² are available concerning the precise reductions in ambient levels of HC and NO_x in the SCAB which will be required to meet the California oxidant standard of 0.1 ppm, hourly average.* Thus, the extent of emission controls required and the most cost-effective and societally acceptable means of implementing such controls remains incompletely defined at this date.

One of the most important bodies of chamber data regarding this problem was that obtained by Dimitriades in a series of experiments conducted in the late 1960's at the U. S. Bureau of Mines.^{15,16} The present SAPRC investigation, described in this report, is an independent study of similar design, although with some significant differences in methodology, including extension to lower NO_x concentrations than those previously investigated, and the use of a smog surrogate accounting for all major types of primary emission sources in Los Angeles rather than auto exhaust alone.

In this section, the SAPRC chamber data will be analyzed in terms of two aspects of the major air pollution problem defined above: (a) is the Federal air quality standard for NMHC of 0.24 ppmC (6-9 AM average) appropriate for achieving the California oxidant standard and (b) what role does the control of NO_x play in reducing ozone levels in general, and in the SCAB in particular?

Analysis of Chamber Data. Ozone data from chamber runs 10 through 73, with the exception of those which had very low (<3%) initial NO₂/NO_x ratios (see Table 4), provided values for the time required in each run to produce 0.1 ppm ozone in the chamber. Although both the California and Federal ambient air quality standards are written in terms of oxidant, the analysis in this section will be in terms of ozone, since

*The philosophy of the National Academy of Sciences⁵² regarding the equivalence between the California and Federal air quality standards for oxidant will be adopted in this report: "The Federal standard for oxidant is 0.08 ppm. The California standard is 0.1 ppm. Both are 1-hour averages. The difference between these standards is equal to the typical background value of 0.02 ppm. These two values can be considered as if they were essentially the same standard. The models that relate oxidant to HC and NO_x are not refined enough at this time to distinguish between these two standards."

it was measured specifically in these experiments and since it is by far the dominant oxidant under most conditions. The time required for ozone to reach 0.1 ppm is plotted logarithmically in Figure 11 as a function of initial oxides of nitrogen concentrations for the series of five total non-methane hydrocarbon concentrations employed in this investigation. It should be noted that the functions plotted in Figure 11 have well defined minima whereas the data of Dimitriades,^{15,16} when plotted in this representation, do not show such minima since his investigation did not extend to sufficiently low NO_x concentrations to observe a turnover in the ozone function.

As can be seen from Figure 11, the minimum in the time to reach 0.1 ppm ozone for each hydrocarbon level occurs at nearly constant NO_x concentration, but the value of the minimum time is an inverse function of the hydrocarbon concentration as shown in Table 9.

Table 9. Values Characterizing the Minimum Time to Reach 0.1 ppm Ozone at Five Non-Methane Hydrocarbon Concentrations for a Six-Hour Irradiation

Non-CH ₄ Hydrocarbon (ppmC)	Nitrogen Oxides (ppm)	Minimum Time (minutes)
0.45	0.048	122
0.62	0.050	97
0.76	0.055	94
1.32	0.058	46
2.13	0.055	40
Average		0.053

The experimental data have been extrapolated to a non-methane hydrocarbon concentration of 0.24 ppmC to obtain an estimate of the minimum time required to reach 0.1 ppm ozone for an ambient NMHC concentration equal to the Federal air quality standard for NMHC. The extrapolation was accomplished using a weighted least squares fit of the logarithm of the

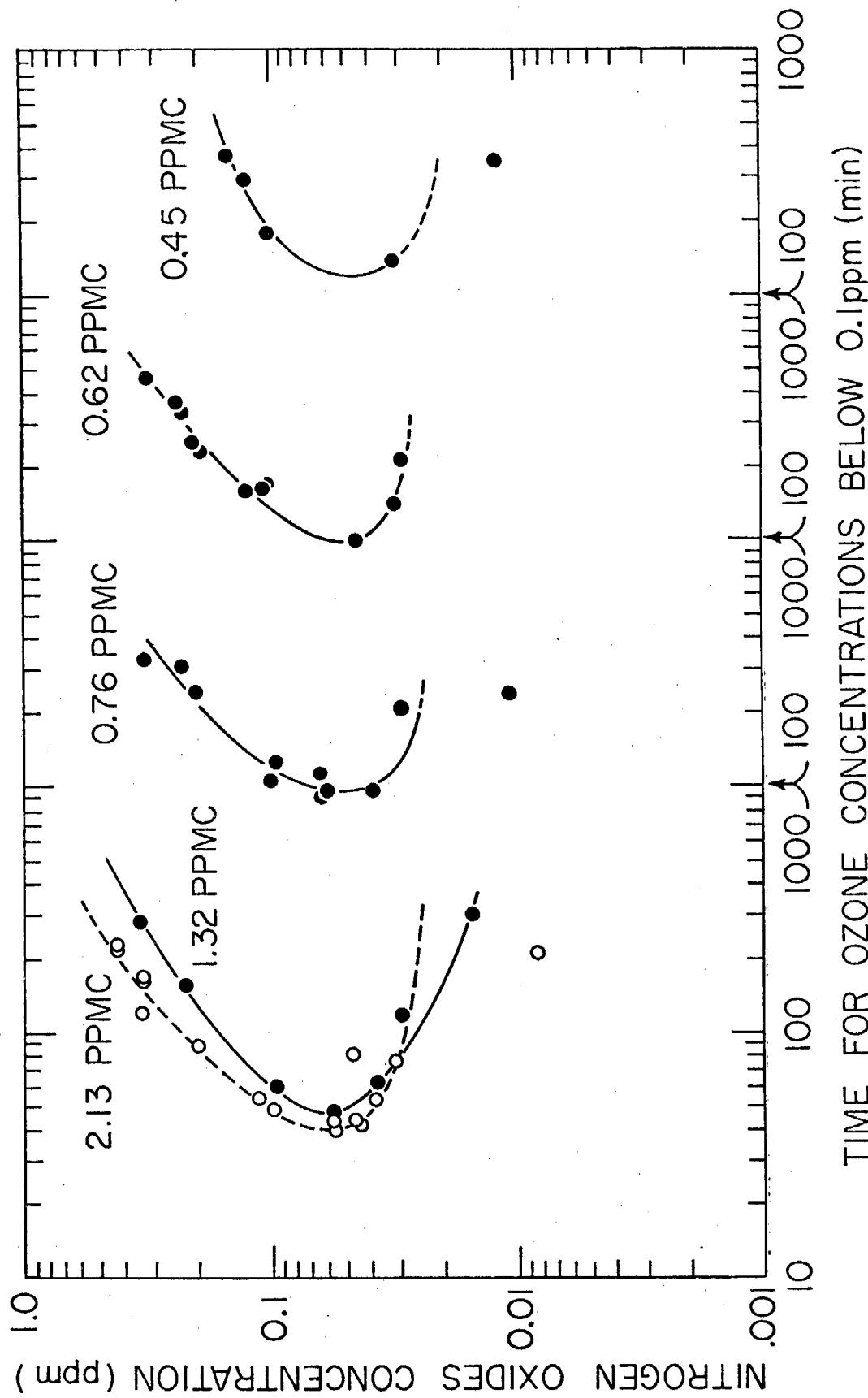


Figure 11. Logarithmic Plot of Irradiation Time Required to Reach 0.1 ppm Ozone as a Function of Initial NO_x Concentration for Various Initial Non-Methane Hydrocarbon Concentrations

minimum time versus the reciprocal of NMHC as shown in Figure 12. The extrapolation to 0.24 ppmC NMHC yields a minimum time required to reach 0.1 ppm O_3 of 6 hours with an estimated uncertainty of ± 2 hours. Since in the eastern portion of the South Coast Air Basin maximum ozone values for a given day occur some 9-11 hours after sunrise, the calculated value of 6 hrs to reach 0.1 ppm O_3 (for an initial NO_x concentration of 0.05 ppm and an initial NMHC concentration of 0.24 ppmC) suggests that for this particular NO_x concentration satisfaction of the Federal NMHC air quality standard would not guarantee satisfaction of the California air quality standard for oxidant.

Reductions in NMHC and NO_x Required to Meet the California Air Quality Standard for Oxidant in the SCAB. Because the NO_x concentration of 0.05 ppm treated above corresponds to the shortest time to reach 0.1 ppm ozone (i.e., the minima in Figure 11), it represents a worst case, and for NO_x concentrations either higher or lower than this value, the time required to reach 0.1 ppm for an NMHC concentration of 0.24 ppmC will be longer than 6 hours. Table 10 shows the times to reach 0.1 ppm

Table 10. Time to Reach 0.1 ppm Ozone for Several Initial NO_x Concentrations at Five Non-Methane Hydrocarbon Concentrations

NMHC (ppmC)	NO_x (ppm)	0.30	0.20	0.10	0.02
<u>Time to Reach 0.1 ppm Ozone (min)</u>					
0.45		830	520	270	480
0.62		445	270	145	175
0.76		370	220	125	230
1.32		240	140	60	81
2.13		140	83	47	89

ozone for four other initial NO_x concentrations (three above and one below 0.05 ppm initial NO_x) at the five NMHC concentrations studied. Extrapolation of weighted least squares fits of these data to an NMHC concentration of 0.24 ppmC yielded times to reach 0.1 ppm ozone of 82, 56, 29 and 55 hours for initial NO_x concentrations of 0.30, 0.20, 0.10 and 0.02 ppm, respectively.

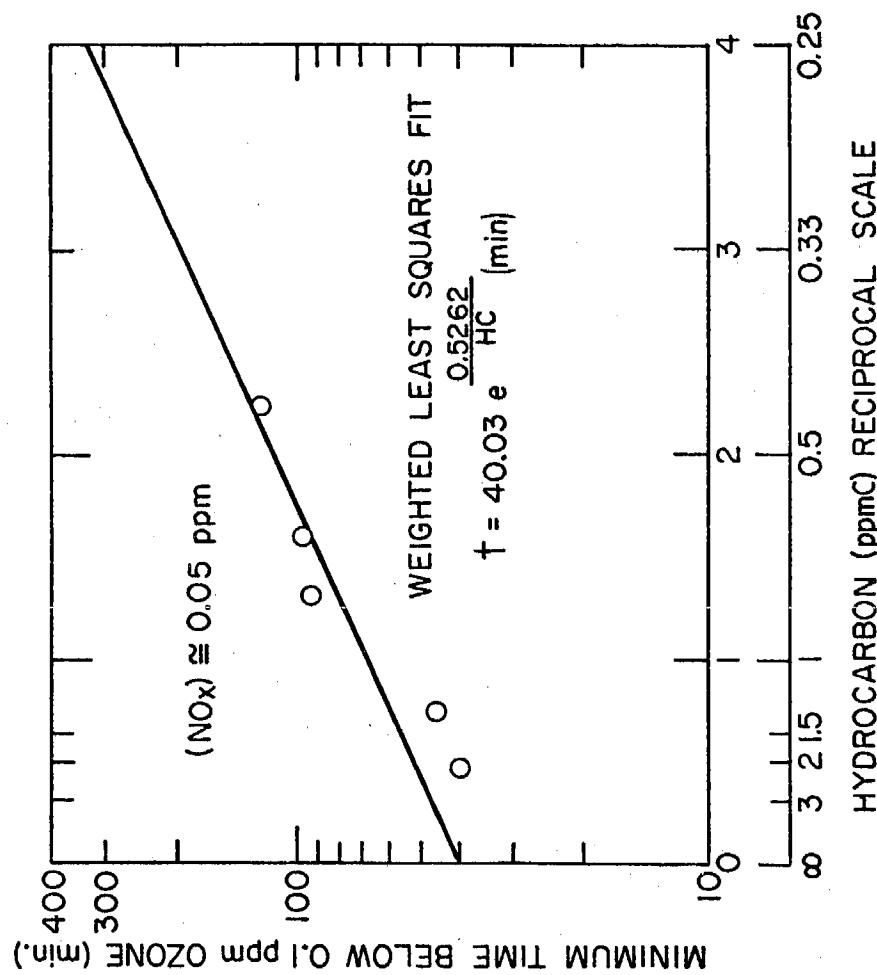


Figure 12. Dependence of Minimum Time Required to Reach 0.1 ppm Ozone on Non-Methane Hydrocarbon Concentration

The latest peaks in ozone concentration occurring within the geographical boundaries of the South Coast Air Basin generally are observed in the eastern end of the basin at approximately 1500 to 1700 hours, i.e., approximately 9-11 hours from sunrise. Thus, the times to reach 0.1 ppm ozone calculated above (~30-80 hours) suggest that for ambient NO_2 concentrations at or below the California NO_2 standard (0.25 ppm 1-hour average, equivalent to approximately 0.30 ppm initial NO_x in our studies*) the Federal standard for 6-9 AM NMHC of 0.24 ppmC would lead to satisfaction of the California ambient air quality standard for oxidant (except as shown above, possibly in the eastern portion of the SCAB for a critical ambient NO_x concentration of approximately 0.05 ± 0.01 ppm). The margin of safety in meeting the oxidant standard would decrease as ambient NO_x levels were reduced below the state standard of 0.25 ppm for 1 hour (equivalent to 0.30 ppm initial NO_x), with the minimum margin of safety and possible violation of the State oxidant standard in the eastern portion of SCAB occurring for NO_x concentrations at approximately 0.05 ppm.

Figure 13 is a representation of the chamber data which clearly shows that as NO_x levels are lowered, greater reductions in NMHC are required to meet the California air quality standard for oxidant. The data points in this plot are the NO_x concentrations for which 300 minutes (in a 360-minute chamber run) were required to reach 0.1 ppm of ozone for each of the five total NMHC concentrations studied. Thus, the points represent the limiting NO_x

* The problem of relating initial NO_x concentrations in chamber runs to the California air quality standard for NO_2 has not lent itself to a simple solution to this date. By assuming that NO_2 data are log-normally distributed and using the equivalency procedure of Larsen,⁵³ the NAS⁵² calculated that the 3-hour average NO_2 value comparable to the California air quality standard for NO_2 (0.25 ppm, 1-hour average) is approximately 0.19 ppm. They then adopted as a conservative estimate of the equivalent 6-9 AM NO_x concentration a value of 0.3 ppm. On the other hand, from chamber data, Dimitriades concluded that a 3-hour average NO_x concentration of 0.33 ppm was equivalent to the California 1-hour average NO_2 standard. For the purposes of this report, we will take the 3-hour average NO_x concentration of 0.30 ppm adopted in the NAS Report⁵² as equivalent to the California air quality standard for NO_2 (0.25 ppm, 1-hour average). We will further assume that 6-9 AM three-hour average NO_x concentrations are equivalent to the initial NO_x concentrations in our chamber runs.

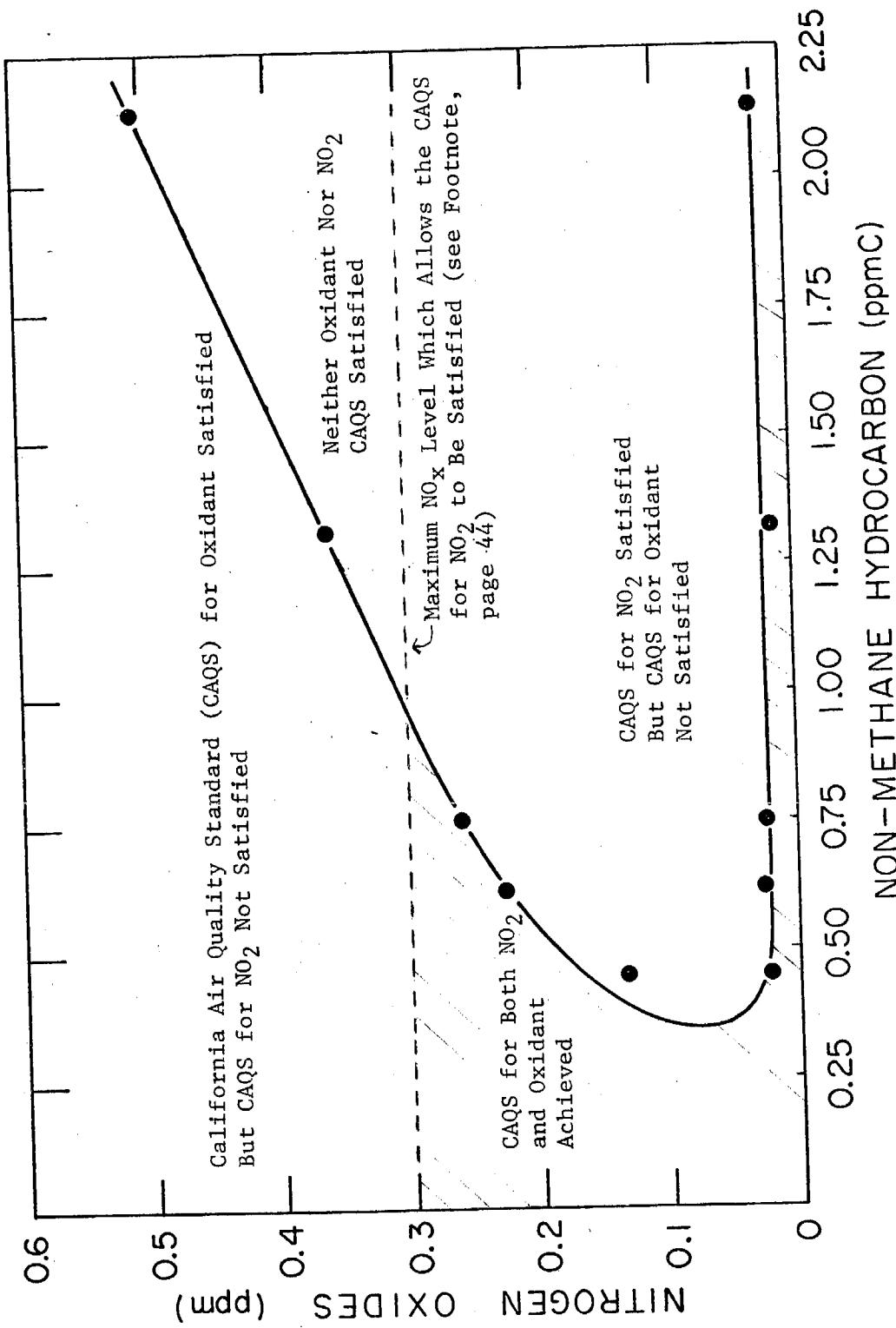


Figure 13. Boundary Curve for Ozone ≥ 0.1 ppm for at Least One Hour During Six-Hour Chamber Irradiations and Indication of Regions Where California Air Quality Standards (CAQS) for NO₂ and Oxidant Are, or Are Not, Satisfied.

concentrations (for a given NMHC concentration) such that 0.1 ppm ozone is not exceeded for more than one hour. The specific values of NO_x employed in Figure 13 are as follows:

NON-METHANE HYDROCARBON CONCENTRATION (ppmC)	NO _x CONCENTRATION (ppm)	
	Upper	Lower
0.45	0.133	0.022
0.62	0.226	0.028
0.76	0.260	0.024
1.32	0.360	0.016
2.13	0.504	0.024

There is considerable uncertainty in the lower NO_x concentrations due to the experimental difficulties in working at these very low concentrations, but since these values are well outside the capabilities of current control technology, (as far as ambient air concentrations) they are of somewhat academic interest.

If, in addition to the boundary curve corresponding to the California oxidant standard in Figure 13, we identify the maximum NO_x level which allows the California air quality standard for NO₂ to be satisfied (see footnote page 44), a "four region" plot is obtained as shown. A given ambient air data point for 6-9 AM NMHC and NO_x concentrations can then be located on Figure 13 (or an extension of it) and estimates made of the reductions in NMHC and/or NO_x necessary to reach the (hatched) region corresponding to satisfaction of the California standards for both NO₂ and oxidant.

For example, taking the highest ambient 6-9 AM NMHC concentration observed at station 001 in Los Angeles in 1974 (4.3 ppmC), a drastic reduction in NMHC, of order 94%, would be required to reach the Federal NMHC standard of 0.24 ppmC which would (according to our chamber data) ensure satisfaction of the California oxidant standard for all NO_x concentrations with the possible exception of 0.05 ppm as discussed above. However, it is clear from the very long times to reach 0.1 ppm O₃ (i.e., 30-80 hours) calculated above for the Federal NMHC standard and the higher NO_x levels of 0.1, 0.2 and 0.3 ppm, that if NO_x control was limited

to only that required to produce ambient levels of NO_x in the range 0.2-0.3 ppm, a higher NMHC concentration could be tolerated while still meeting the California oxidant standard. Thus, from Figure 14 (which was constructed from weighted least squares fits of the data in Table 10), assuming that the latest ambient oxidant peaks in the SCAB occur 9 hours after sunrise, NMHC values (to achieve the California oxidant standard) of 0.44 and 0.57 ppmC are calculated for initial NO_x concentrations of 0.2 and 0.3 ppm, respectively. Hence, under the assumptions made concerning the equivancy between initial NO_x and NMHC concentrations in the chamber experiments to ambient 6-9 AM average concentrations (and using the highest 6-9 AM NMHC value observed at Station 001 in 1974), for ambient 6-9 AM NO_x concentrations from 0.2-0.3 ppm only approximately 88% reduction in ambient 6-9 AM NMHC levels (i.e. from 4.3 to ~0.5 ppmC) would be required to meet the 0.1 ppm State oxidant standard rather than the 95% reduction required for the worst NO_x case of 0.05 ppm.

In summary, assuming drastic reductions in ambient 6-9 AM NMHC concentrations could be achieved, simultaneous reductions in ambient NO_x values below those necessary to meet the California ambient air quality standard for NO_2 would reduce the margin of safety (for a given NMHC reduction) with respect to satisfaction of the oxidant standard. However, the important offsetting benefits from reduced levels of nitrous and nitric acid, organic nitrates such as PAN, and of particulate nitrate must be weighed against the decreasing margin of safety for ozone reduction in ultimately deciding upon the specific degree of NO_x control which is to be implemented.

Finally, it must be emphasized again that in addition to inherent uncertainties in the chamber data, significant assumptions and extrapolations have been made in the calculations reported above. We have tried to identify these explicitly in the course of the discussion. Perhaps the greatest limitations of the present chamber data were the restriction of irradiation times to 6 hours, and the lack of simulation of air parcel transport, principally the fresh injection of pollutants during the irradiation (some dilution, a second characteristic associated with air parcel transport, was inherent in the experiment). Longer irradiations and simulation of air parcel transport would provide more direct and valid data concerning the reductions in ambient NMHC and NO_x levels required

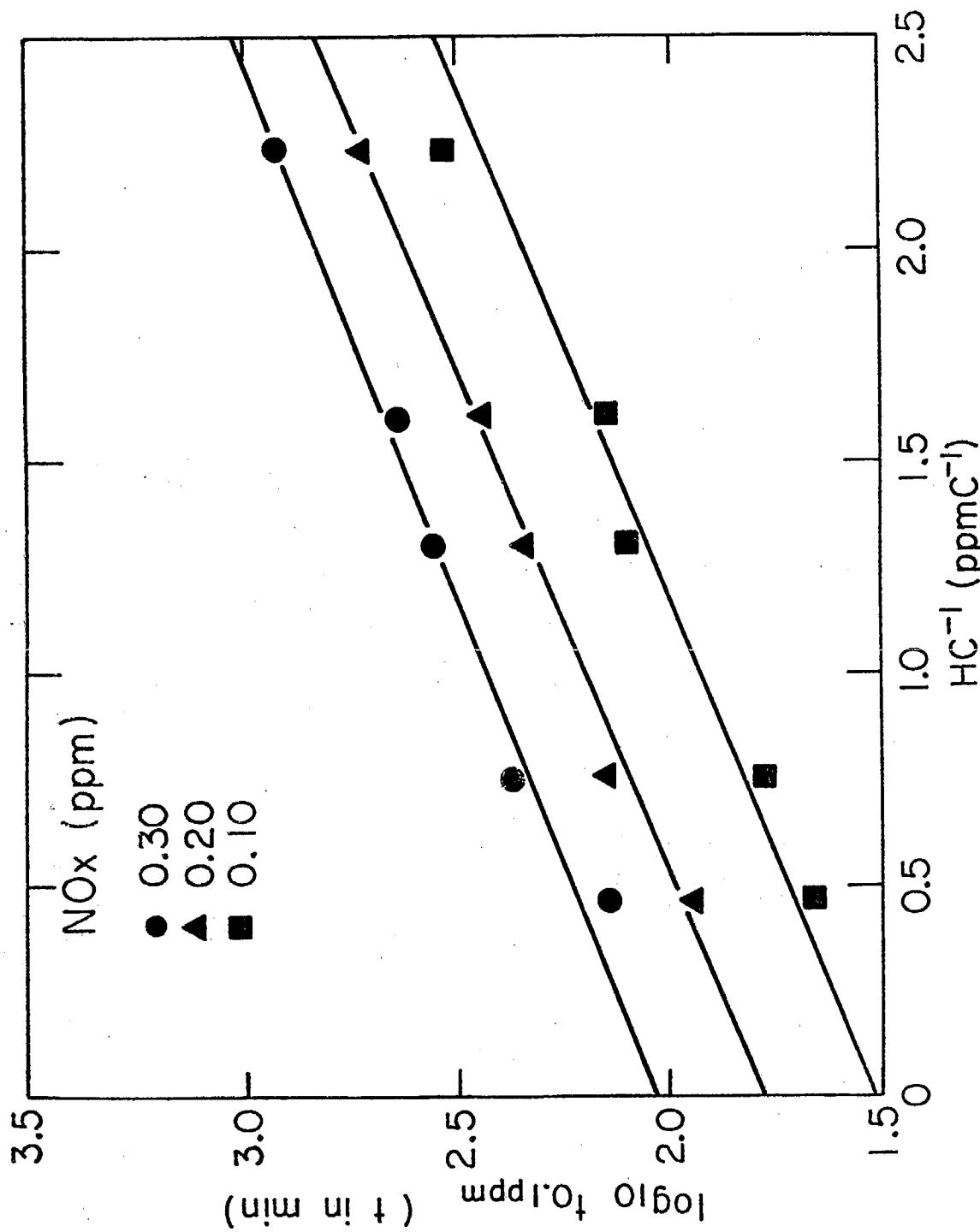


Figure 14. Dependence of Time Required to Reach 0.1 ppm Ozone on Non-Methane Hydrocarbon Concentration for Three NO_x Concentrations

to satisfy the California air quality standard for oxidant in the far downwind regions of the SCAB. Furthermore, if longer irradiations were conducted for an additional NMHC isopleth at 0.24 ppmC, the results obtained would obviate the need to carry out the extrapolations made in the preceding calculations.

Although these refinements in the chamber data are desirable and needed, the HC- NO_x -Ozone data base already obtained is clearly of considerable utility. For as the NAS pointed out in their critique of the 1975-76 Federal automobile emission standards for HC and NO_x ,⁵² data such as those reported here. . ."characterize the atmospheric oxidant-producing system in an experimental chamber and are readily interpretable. This is in contrast to atmospheric data, which often show much scatter and produce ill-defined oxidant curves."

B. Preliminary Application of Chamber Data to the Prediction of Effects on Maximum Ozone Levels of Incremental Reductions in Ambient HC and NO_x

Although the analysis of the chamber data in the previous section provides information on the reductions in ambient NMHC and NO_x levels which are likely to allow the California (or Federal) "one-time-a-year" oxidant standard to be met, it does not readily provide information on the benefits (or lack thereof) to be expected from small reductions in ambient NMHC and/or NO_x levels. Yet it is precisely the case of modest incremental reductions in emissions, for example, from new car emission controls, vapor recovery etc., which is of immediate practical concern, rather than a sudden massive reduction in emissions to immediately meet the ambient air quality standards since such large scale emission reductions are unlikely to occur within present economic and societal limitations. A specific example of a program leading to an incremental reduction in emissions is the NO_x retrofit program for 1966-70 model year cars which is currently being implemented in the South Coast Air Basin of California and which is being attended by a debate as to the magnitude of improvement in air quality, if any, due to the modest reductions in NO_x and NMHC which are involved. This section will suggest one method by which the chamber data may be applied to an assessment of control strategies such as the NO_x retrofit program.

The maximum ozone produced for given NMHC and NO_x levels after 6 hours of chamber irradiation is one of the parameters which is obtained directly from the experimental data. Because of the exceptional inertness of the glass chamber with respect to ozone decay,³ the ozone concentration at the end of a 6-hour irradiation has been, in every run to date, the maximum ozone concentration for that run. Thus, a plot (Figure 15) of 6-hour ozone levels vs initial NO_x concentration for the various NMHC concentrations employed in this study (data from Table 7), provides a basis for evaluating the maximum ozone to be expected for any initial NO_x concentration for the various experimental NMHC levels. However, this presentation does not readily allow estimates of maximum ozone for NMHC levels other than the experimental ones because of the nonlinear dependence on NMHC of the ozone maxima.

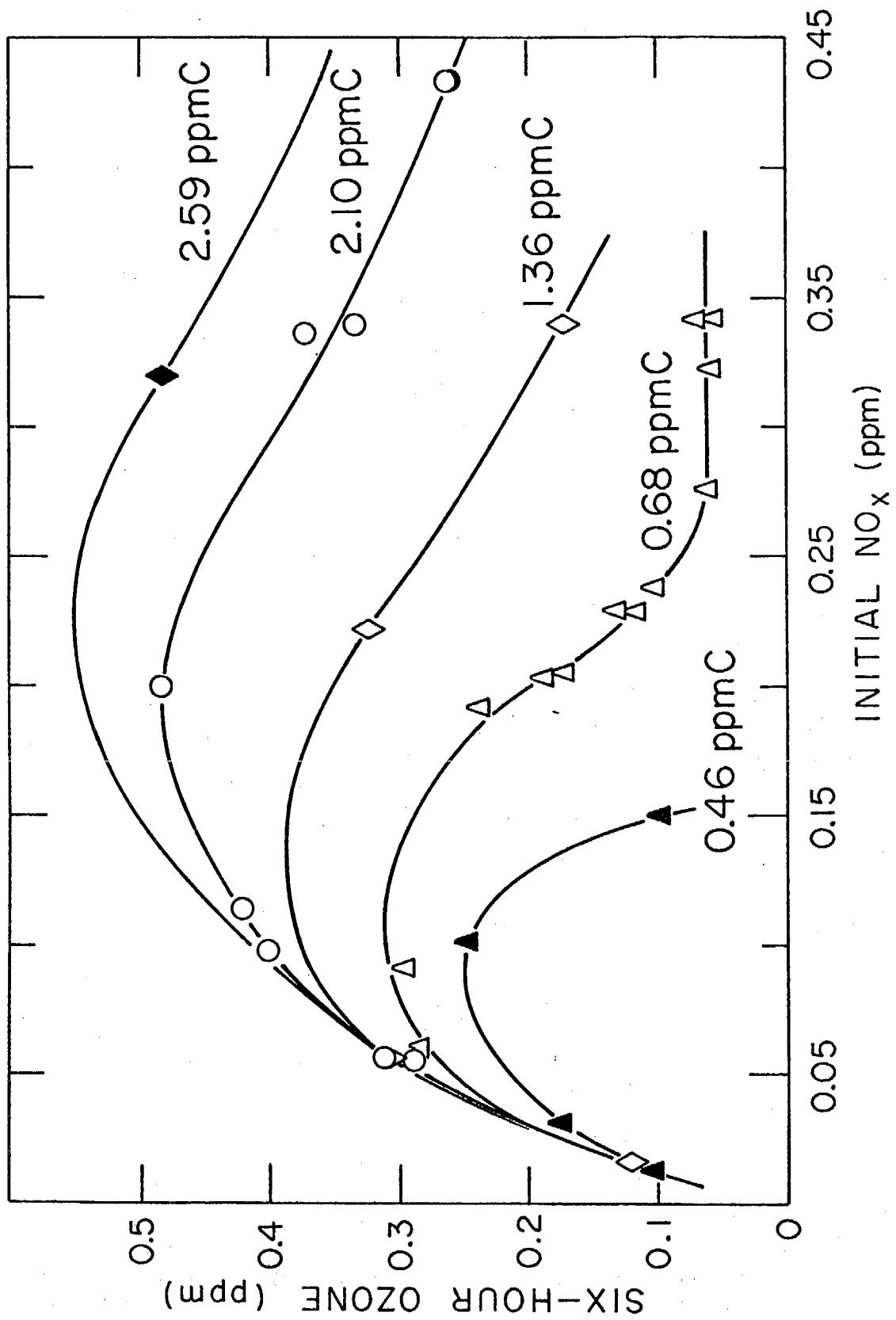


Figure 15. 6-Hour Ozone Concentrations as a Function of Initial NO_x at Various Non-Methane Hydrocarbon Levels

To facilitate interpolation between the experimental NMHC levels, as well as to allow for extrapolation to somewhat higher NMHC concentrations, it is useful to construct a plot of maximum ozone vs initial NMHC for various NMHC/NO_x ratios. Table 11 summarizes the data used for construction of such a plot shown in Figure 16. For each NMHC/NO_x ratio selected, the NO_x level corresponding to an experimental NMHC level is calculated from [NO_x] = $\frac{[\text{NMHC}]}{\text{ratio}}$. The maximum ozone corresponding to this calculated NO_x concentration is then read from the correct NMHC isopleth in Figure 15. It is then possible to plot maximum ozone as a function of initial NMHC for various NMHC/NO_x ratios.

Inspection of Figure 16 indicates that over the NMHC concentration range 1.36 to 2.59 ppmC the ozone maxima increase linearly with increasing NMHC for constant NMHC/NO_x ratio. By utilizing a linear interpolation between the NMHC/NO_x ratio lines, any incremental reduction in NMHC and NO_x levels can be easily evaluated. Several specific cases are summarized in Table 12 and are discussed therein.

The base conditions for these calculations are those selected for the original surrogate mixture (2.40 ppmC except HCHO, and 0.30 ppm NO_x) and are considered representative of early morning ambient levels in the Los Angeles atmosphere. The ozone maximum of 0.46 ppm predicted for these initial conditions is read from the NMHC/NO_x = 8 line at 2.4 ppmC NMHC.

The percentages calculated for cases (b) and (c) in Table 12 show that reductions in NO_x accompanied by little or no reduction in NMHC will lead to increases in 6-hour ozone values while for equal reductions in NMHC and NO_x, case (a), a small reduction in 6-hour ozone is predicted. Cases (d), (e), and (f) for more substantial NMHC reductions indicate that, within the limitations of the chamber data and these calculations, the "linear rollback of reactive hydrocarbons" concept for reducing oxidant will be valid even if the NMHC reduction is accompanied by a modest simultaneous reduction in NO_x.

The analyses presented here were intended only to provide preliminary examples of one potential application of the chamber data obtained in this program. An expanded, and considerably more refined and detailed, set of calculations of this type concerning the NO_x retrofit program for 1966-1970 light duty vehicles in the South Coast Air Basin will be presented in the Final Report to the current ARB Contract, No. 4-214. 54

Table 11. Experimental NMHC, NO_x and Ozone Levels for Selected HC/NO_x Ratios

Ratio	NMHC (ppmC)	NO _x (ppm)	6-Hour O ₃ (ppm)
11	2.59	.235	.548
	2.10	.191	.485
	1.36	.124	.387
	.68	.062	.279
	.46	.042	.200
10	2.59	.259	.540
	2.10	.210	.482
	1.36	.136	.388
	0.68	.068	.288
	0.46	.046	.207
9	2.59	.288	.517
	2.10	.233	.469
	1.36	.151	.387
	0.68	.076	.297
	0.46	.051	.217
8	2.59	.324	.477
	2.10	.262	.440
	1.36	.170	.378
	0.68	.085	.303
	0.46	.057	.227
7	2.59	.370	.425
	2.10	.300	.395
	1.36	.194	.358
	0.68	.097	.309
	0.46	.066	.238
6	2.59	.432	.363
	2.10	.350	.339
	1.36	.227	.317
	0.68	.113	.312
	0.46	.077	.247

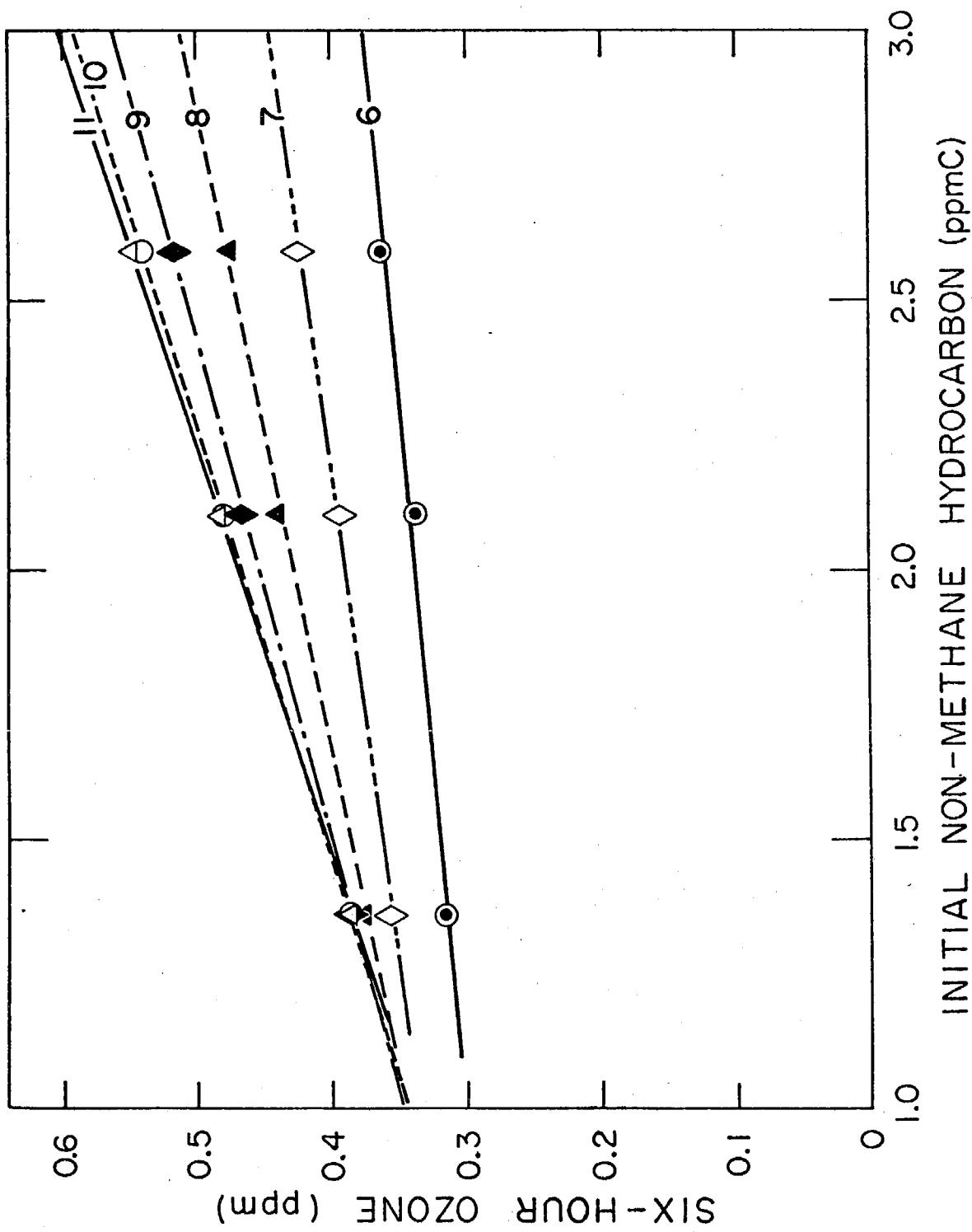


Figure 16. 6-hour Ozone vs. Initial Non-methane Hydrocarbon at Various HC/NO_x Ratios

Table 12. Effects on Ozone Maximum Due to Selected Incremental Reductions in Initial NMHC and NO_x Concentrations

Case	Concentrations			6-Hour (Maximum)			%
	% Reduction	NMHC	NO _x	NMHC (ppmC)	NO _x (ppm)	Ratio NMHC/NO _x	
	0	0	2.40	0.300	8.0	0.46	--
(a)	5	5	2.28	0.285	8.0	0.45	-2
(b)	0	7	2.40	0.279	8.60	0.48	+4
(c)	3	7	2.33	0.279	8.35	0.47	+2
(d)	10	2.5	2.16	0.292	7.38	0.42	-9
(e)	20	5.0	1.92	0.285	6.74	0.37	-20
(f)	30	7.5	1.68	0.278	6.05	0.33	-28

C. Calculation of an Ozone Dosage- NO_x -HC Surface from Smoothed Chamber Data

The ozone dosage accumulated during a 6 hour irradiation has been calculated for each surrogate experiment, and is given on the data sheet for each 6 hour run in Appendix A. These dosages are also presented in Figures 17 through 21 along with approximations to least squares fits to the data. These least squares analyses were attempted in order to generate a preliminary estimate of the smoothed dosage surface. The result is a starting point for further refinement of the least squares calculations and a basis for suggesting informative experiments.

Experiments were first grouped into sets of nearly constant hydrocarbon concentration and plotted (Figures 17-21) in order to obtain some idea of the type of functions that might be made to fit the data. The most prominent features are abrupt and sharp peaks at low nitrogen oxides concentrations, followed by a more gradual decay towards zero dosage at high NO_x concentrations.

If the reasonable boundary condition that ozone dosage be zero at the extremes of nitrogen oxides concentration (0 and ∞) is imposed, and a single rational algebraic function is chosen to represent the data, the representation,

$$y = \frac{x^\ell (a_0 + a_1 x + a_2 x^2 + \dots + a_m x^m)}{1 + b_1 x + b_2 x^2 + \dots + b_n x^n} \quad (1)$$

suggests itself where x is NO_x concentration, and y is ozone dosage. Here $n > (m + \ell)$, $a_0 > 0$, and $\frac{a_m}{b_n} > 0$. As x approaches zero the function asymptotically approaches $y = a_0 x^\ell$ and becomes zero at $x = 0$. As x becomes very large the expression approaches $y = \frac{a_m}{b_n} \frac{1}{x^{n-(m+\ell)}}$ which approaches zero from the positive side at large x . Since only limited data are available for any single hydrocarbon concentration and in addition significant variations occur in some of the data, it follows that the use of only a few constants (parameters) is justified in representing the data. On this basis the initial trial fit was based on the simplest rational function of the form of equation (1).

$$y = \frac{x a_1}{1 + b_1 x + b_2 x^2} \quad (2),$$

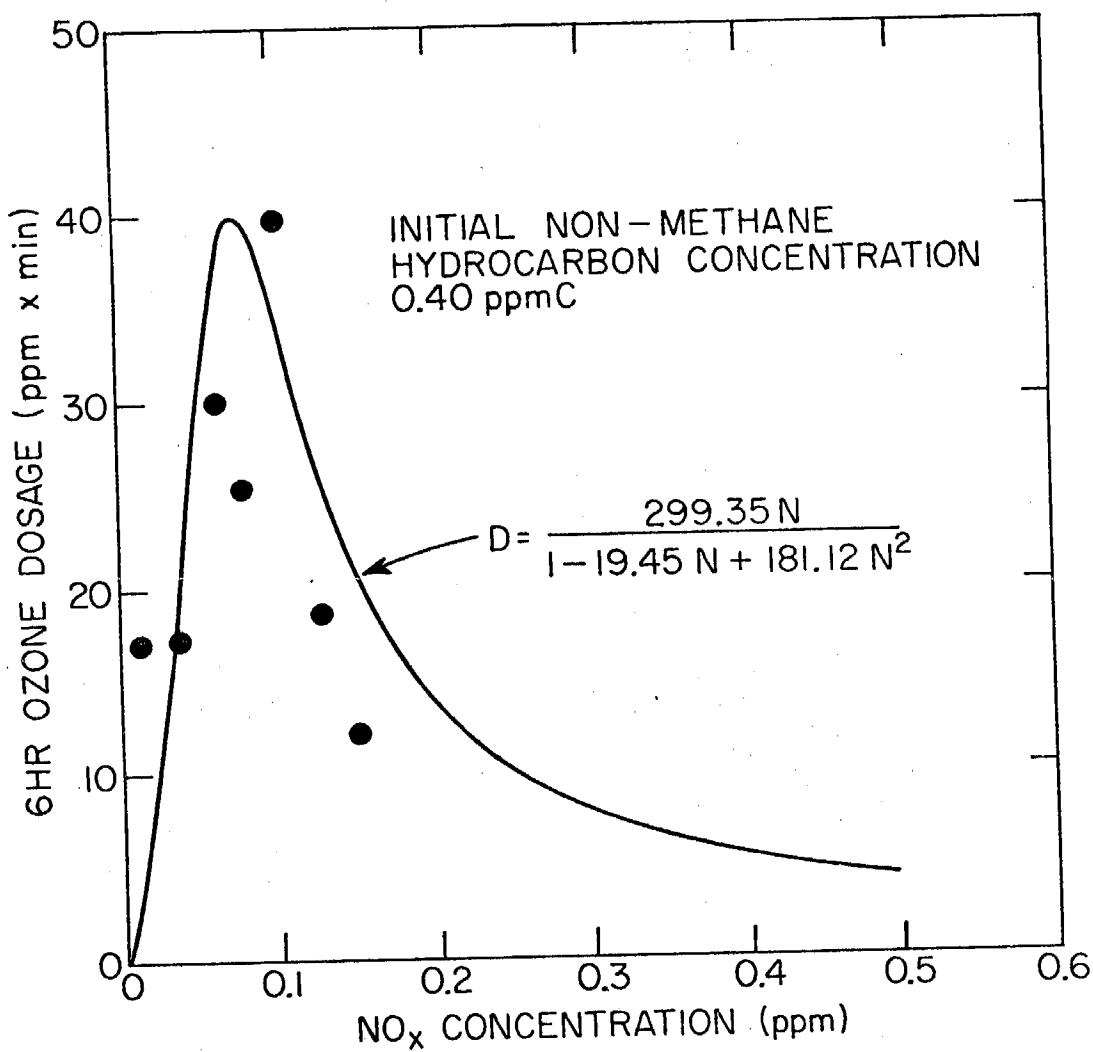


Figure 17. Experimental Values and the First Approximation to a Smoothing Function for an Initial Non-Methane Hydrocarbon Concentration of 0.40 ppmC

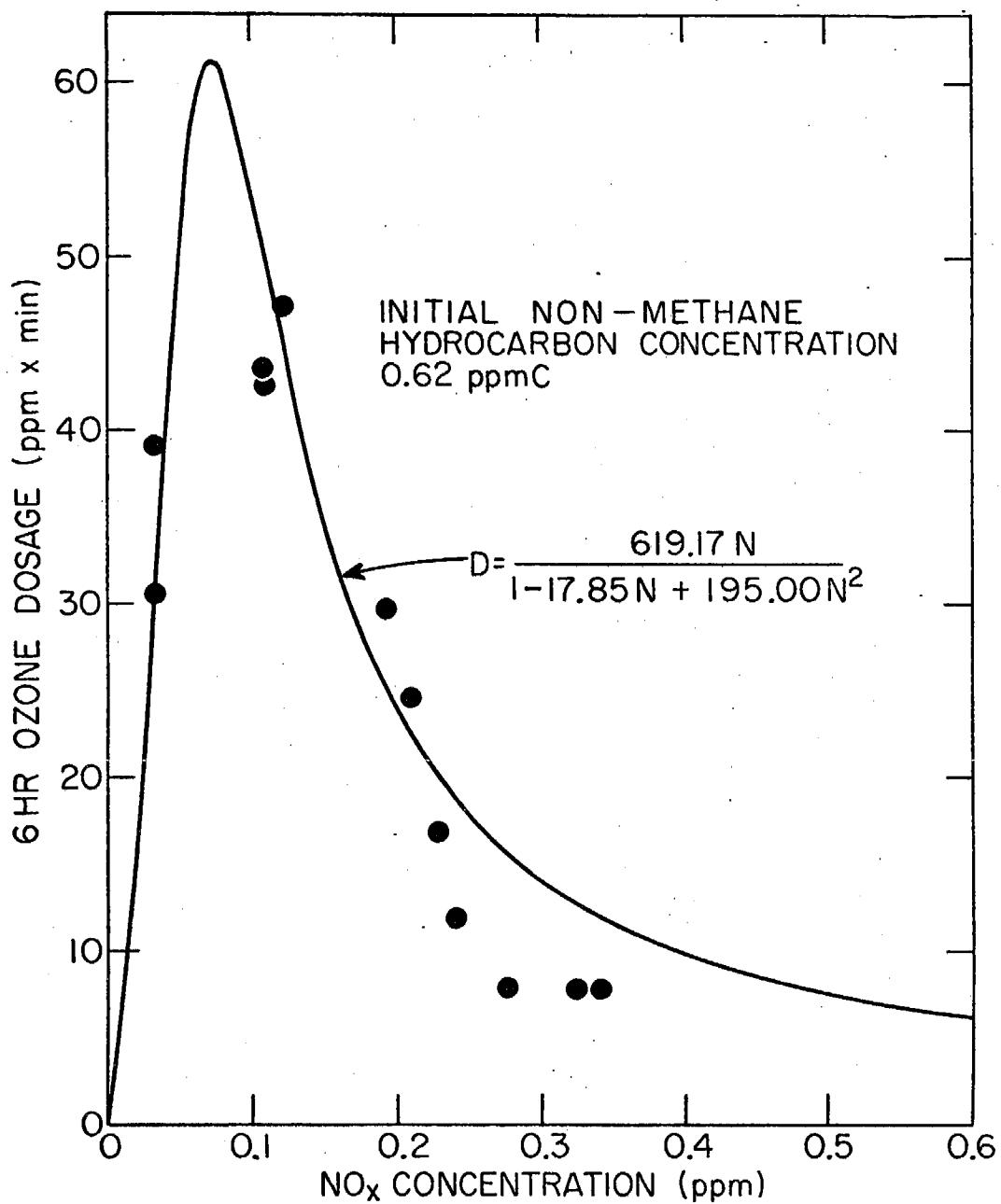


Figure 18. Experimental Values and the First Approximation to a Smoothing Function for an Initial Non-Methane Hydrocarbon Concentration of 0.62 ppmC

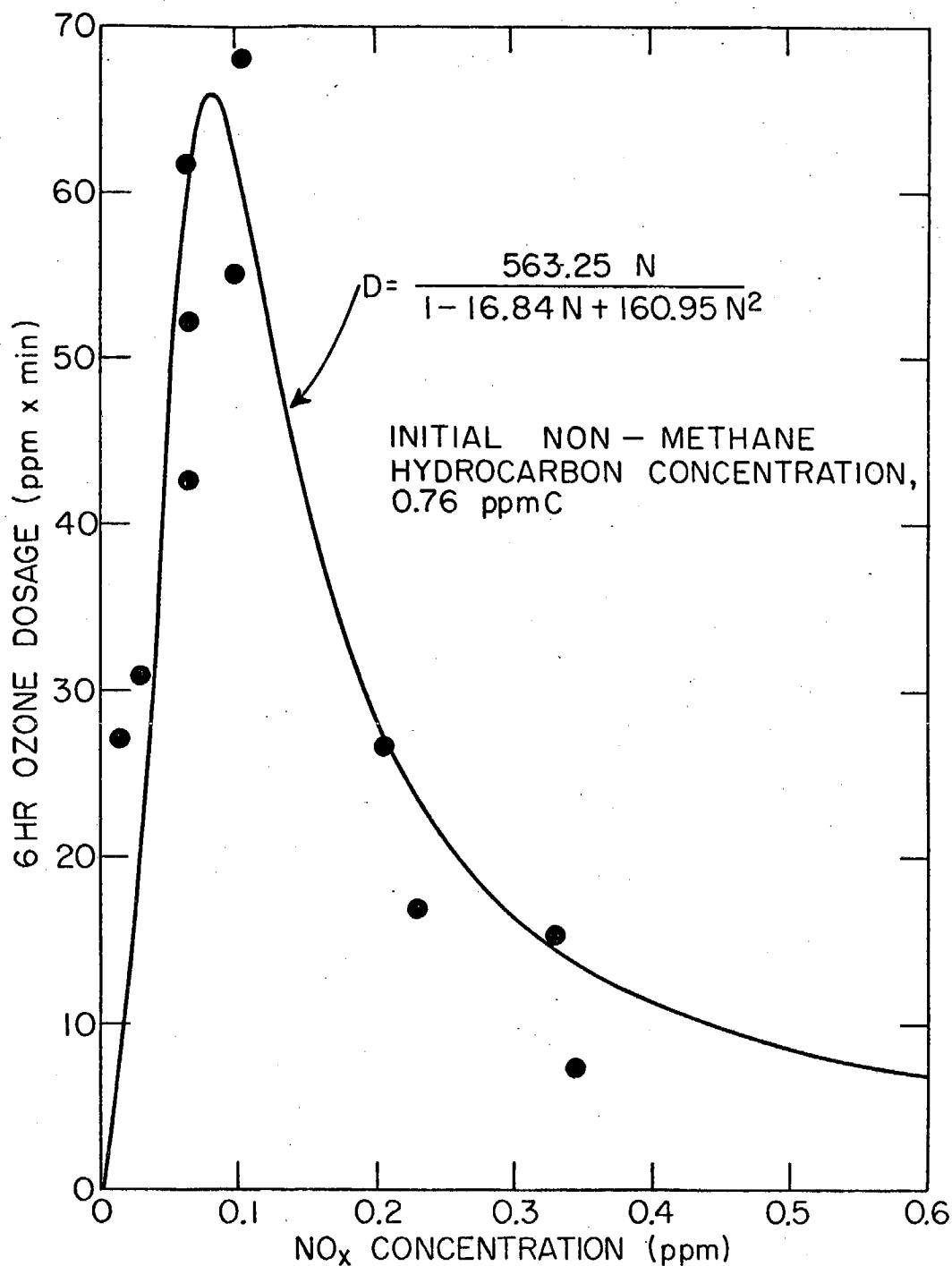


Figure 19. Experimental Values and the First Approximation to a Smoothing Function for an Initial Non-Methane Hydrocarbon Concentration of 0.76 ppmC

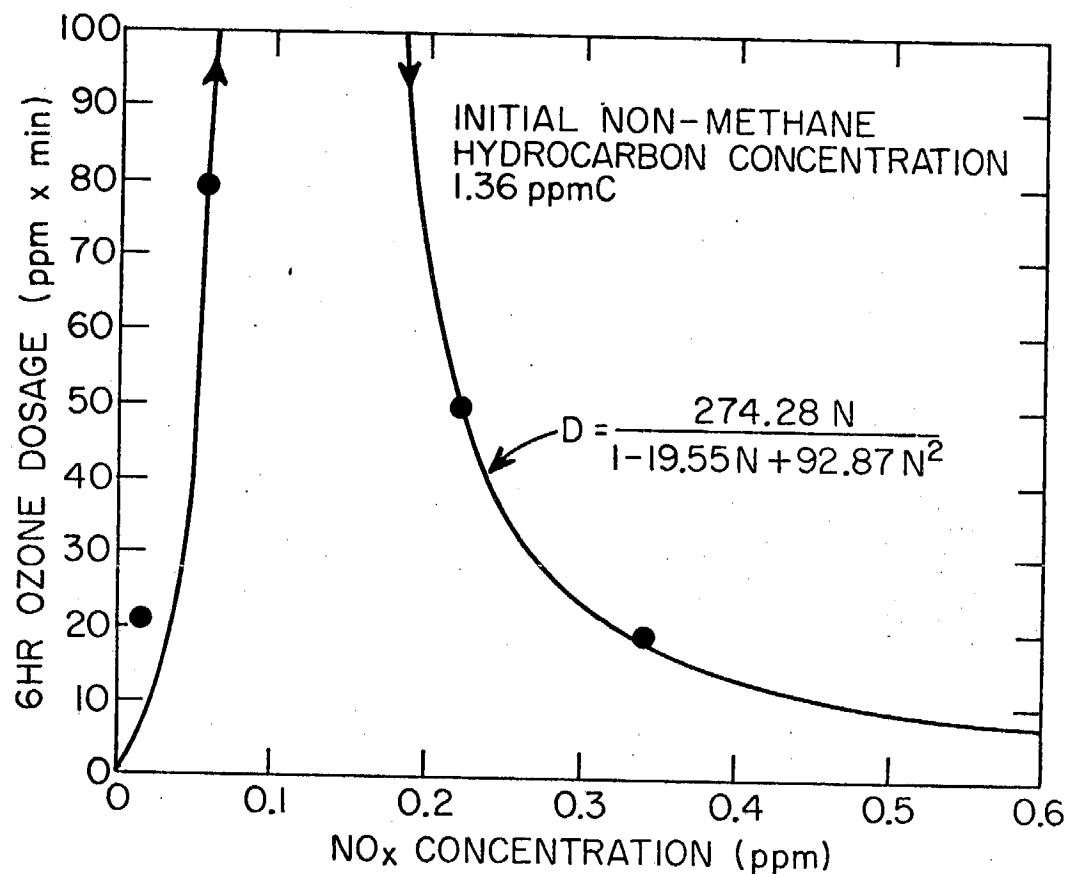


Figure 20. Experimental Values and the First Approximation to a Smoothing Function for an Initial Non-Methane Hydrocarbon Concentration of 1.36 ppmC
(Lack of experimental data near the maximum results in an anomalous smoothing function which was not employed in the present analysis - see text.)

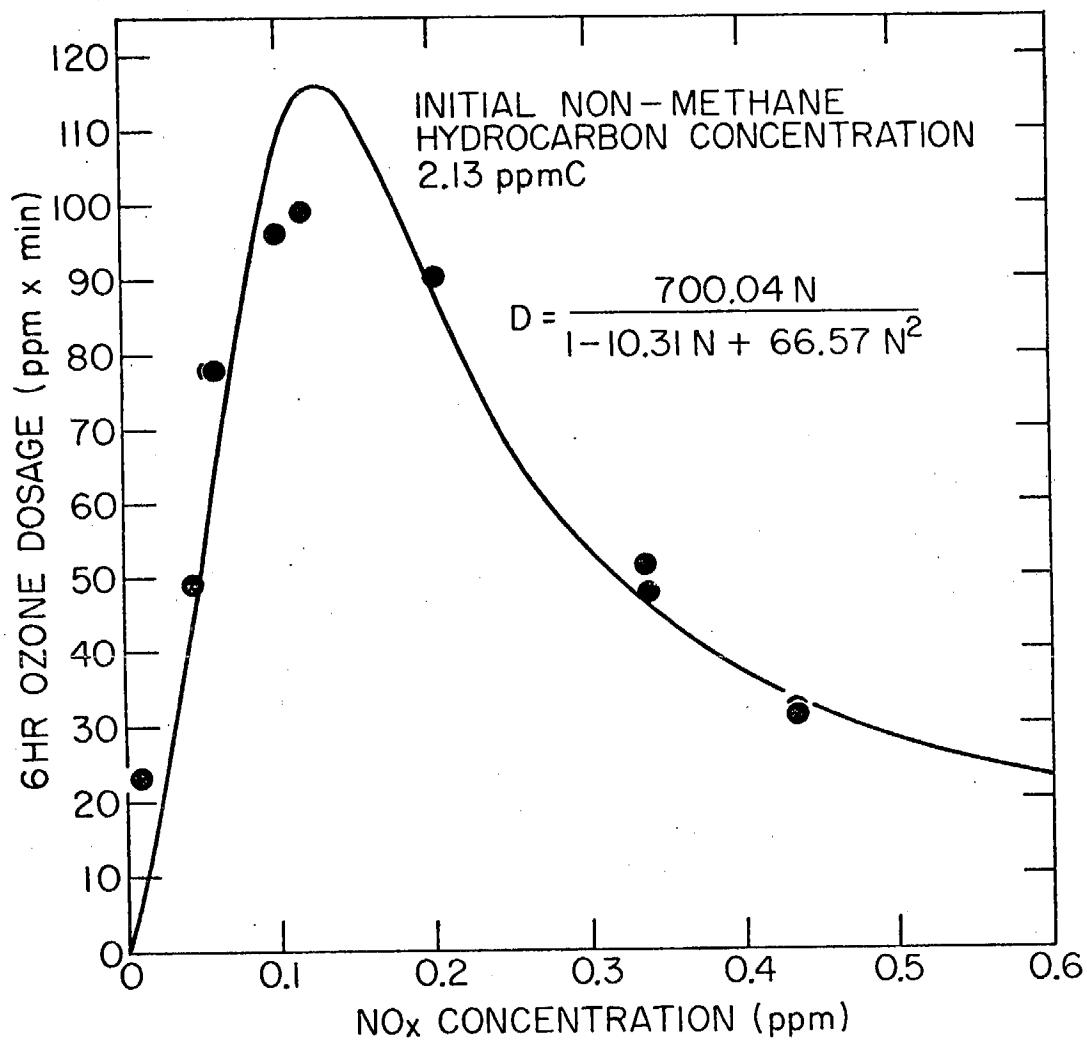


Figure 21. Experimental Values and the First Approximation to a Smoothing Function for an Initial Non-Methane Hydrocarbon Concentration of 2.13 ppmC

which involves three parameters. The peak can be fitted if the poles (roots of the denominator) are complex conjugates whose real parts are near the value of N_{X_0} concentration at the maximum. It thus follows that the values of the parameters, as determined by a least squares procedure, must satisfy the conditions

and therefore

$$\left. \begin{array}{l} \frac{b_1}{b_2} < 0 \\ b_1^2 - 4b_2 < 0 \\ b_1 < 0 \\ b_2 > 0 \end{array} \right\} \quad (3)$$

The least squares procedure used to obtain the fits shown in Figures 17-21 is based on minimizing the expression

$$\sum w_i \left[\frac{x_i}{y_i} - \left(\frac{1}{a_1} + \frac{b_1}{a_1}x + \frac{b_1}{a_1}x^2 \right) \right]^2 \quad (4)$$

where the weights, w_i , are chosen to approximately counteract the use of the reciprocal dosage, $1/y_i$, in the least squares expression and yield a minimum value for the absolute variance,

$$\frac{\sum (Y_i - y_i)^2}{n}$$

where n = number of fitted points, and Y_i is the dosage calculated from equation (2). Consequently, the percentage error in estimation will tend to be large at small dosages when using the fitted expressions.

The weights were calculated from

$$w_i = \frac{y_i^4}{\sum_j y_j^4} \quad (5)$$

based on the concept that

$$\left[\delta \left(\frac{1}{y_i} \right) \right]^2 = \left(- \frac{\delta y_i}{y_i^2} \right)^2 = \frac{\delta y_i^2}{y_i^4}$$

This procedure heavily weights relatively large dosage values and probably exaggerates the peaks.

If the percentage error is to be minimized, then similar intuitive reasoning suggests the weights

$$w_i = \frac{y_i^2}{\sum_j y_j^2}$$

These weights were not used because the variation in dosage for replicate experiments suggests that an assumption of constant absolute variance is a better approximation than a constant percentage error.

Table 13 gives the values of the parameters (a_1 , b_1 , b_2) calculated for various hydrocarbon concentrations. Figure 22 shows the parameter values plotted against hydrocarbon concentration. Also shown are fitted curves to analytically represent the hydrocarbon dependence. These curves were obtained by least squares procedures neglecting the dubious points at 1.36 ppmC. The fitted expressions are

$$a_1 = \frac{675.85H}{1 - 0.8421H + 0.5522H^2} \quad (6)$$

$$-b_1 = 25.469 - 6.1939H \quad (7)$$

$$b_2 = 18.450 - 4.0101H \quad (8)$$

where H is the hydrocarbon concentration.

The form of equation (6) was chosen to ensure that dosage vanishes at infinite hydrocarbon concentration. This may be unnecessary because the dependence of b_2 on hydrocarbon concentration ensures vanishing at infinity even if the simpler a_1 dependence,

$$a_1 = \frac{4016.1H}{1 + 4.3096H} \quad (9)$$

is used. However, equation (9) does not fit the point of 0.4 ppmC as well as equation (6). These questions of the better form for the fitted expressions can only be settled by the acquisition of more chamber data.

Expressions (6)-(8) allow the calculation of a first approximation

Table 13. Least Squares Values for Parameters for Equation (2) Calculated from Dosage Dependence on Initial Nitrogen Oxides Concentration at Various Initial Non-Methane Hydrocarbon Concentrations

Non-Methane Hydrocarbon Concentration (ppmC)	a_1 ppm O_3 X min(ppm NO_x) ⁻¹	b_1 (ppm NO_x) ⁻¹	b_2 (ppm NO_x) ⁻²	Predicted maximum dosage ppm O_3 X min
0.40	299.3	-19.454	181.12	40.1
0.62	619.2	-17.854	194.99	61.5
0.72	563.2	-16.836	160.95	66.0
1.36 ^a	274.28	-19.551	92.868	989.4 ^a
2.13	700.04	-10.313	66.568	115.0

^aThe lack of experimental points near and below the maximum for 1.36 ppmC led to unrealistic values of the parameters and a very large and impossible value for the predicted maximum dosage, see Figure 20.

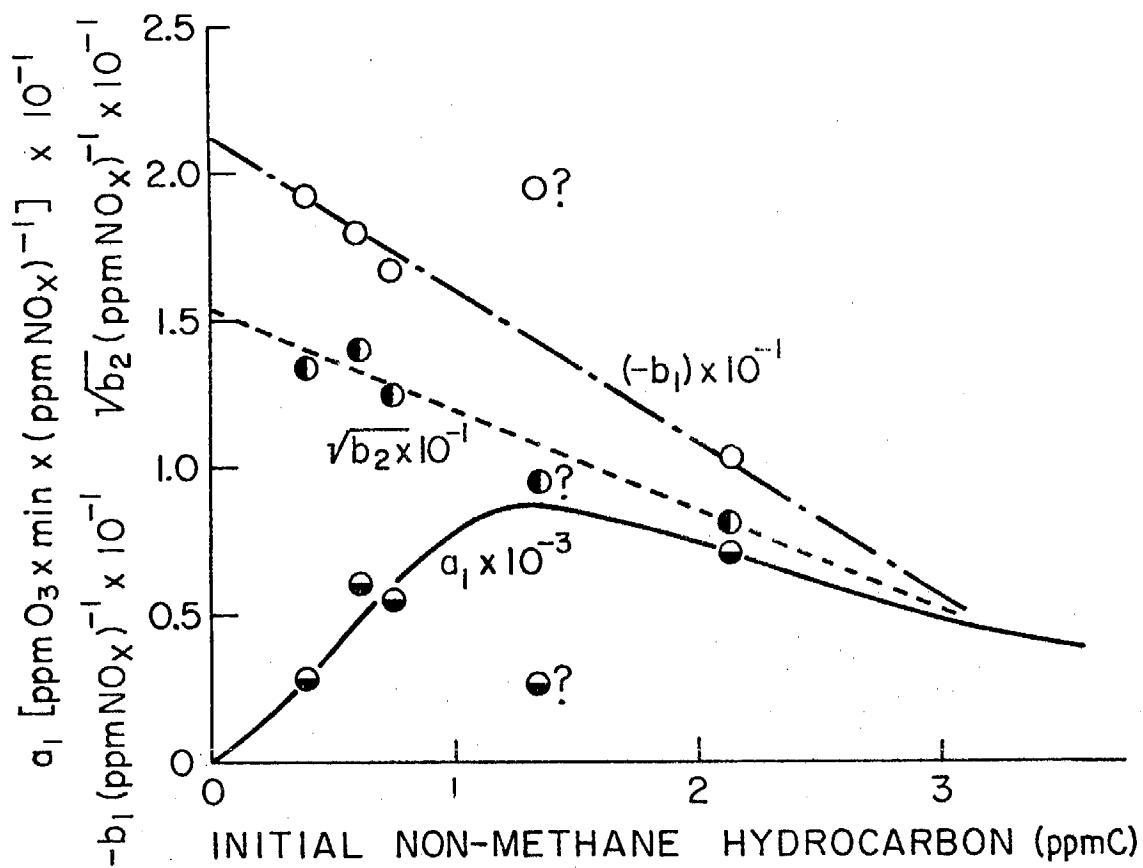


Figure 22. Dependence of Parameters in Equation 2 on Non-Methane Hydrocarbon Concentrations and the Fitted Functions

to the dosage surface. A logarithmic contour map of this surface is given in Figure 23. Points are shown for concentration regions outside the region of probable validity for these expressions ($>2.2 \text{ ppmC}$). This was done to facilitate drawing smooth contour lines and to suggest regions of interest for future experimental exploration.

There is one point in Figure 23 where both the partial derivatives with respect to NO_x and hydrocarbon are zero, marking a slight peak at 0.10 ppm NO_x and 1.75 ppmC non-methane hydrocarbon. According to the extrapolated dosage values this peak lies at the extremity of a plateau at a dosage of about 100 ppm $x \text{ min}$. The validity of this plateau and its extent is unknown; an extrapolation tenuously suggests that it continues beyond 0.4 ppm NO_x ; 4 ppmC surrogate. Within the experimentally explored region the contours are reminiscent of the results of many other chamber oxidant studies although the present contours are more irregular than those usually fitted to this kind of data.

Obviously this picture needs refining and further verification. One obvious need is spot check experiments in concentration regions near the salient features of the contour proposed in the region between 20 ppm minutes and 40 ppm minutes where the air quality standard for oxidant is on the threshold of being violated during a 6-hour period. Extension to dosages for longer irradiation periods is also needed. Intuitively, this would result in the plateau being higher and located at higher concentrations, deforming the other contours accordingly as if the map were on a rubber sheet anchored along the coordinate axes.

Another refinement lies in improving the least squares fit of the surface. One reason for the effort expended to get the above first approximation is that it furnishes a starting point for a computer smoothing of the body of dosage data as a whole by a linearized least squares procedure. This approach is based on a truncated Taylor series expansion of the fitting expression in terms of the seven parameters, p_j ,

$$f(x, p_1 \dots p_7) \approx f(x, p_{1,1} \dots p_{7,1}) + \sum_{j=1}^7 \left(\frac{\partial f}{\partial p_j} \right)_{p_i = p_{i,1}} (p_{j,2} - p_{j,1})$$

where $p_{j,2}$ indicates a second approximation to p_j . The least squares

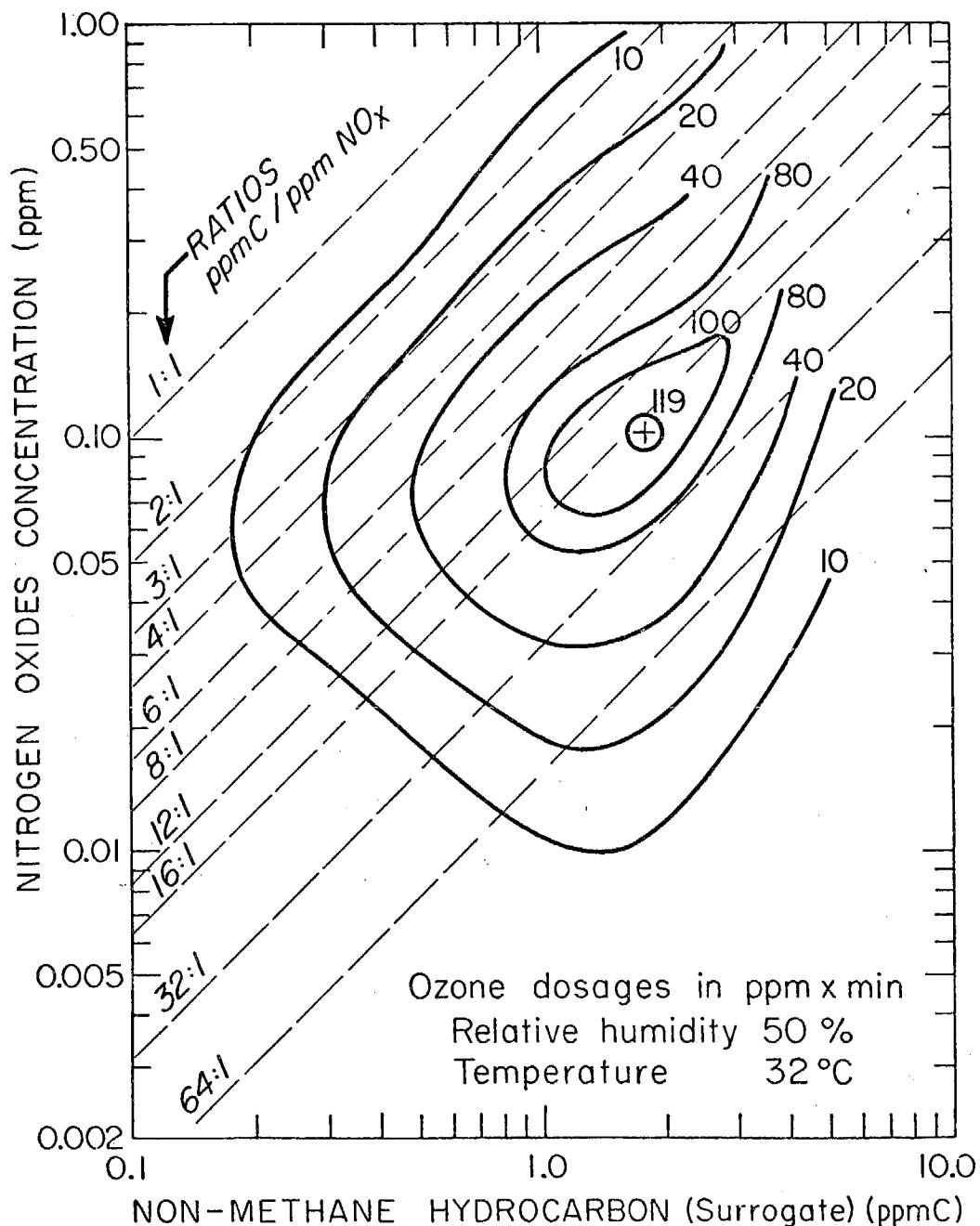


Figure 23. Six-Hour Dosage Contours for Ozone from Smoothed Surrogate Irradiation Data

procedure yields values of $p_{j,2} - p_{j,1}$. This is reiterated until the variance is a minimum or it is found that the procedure diverges.

D. Development of Statistical Methods for Relating Ambient Air Monitoring Data to Results from Smog Surrogate Chamber Irradiations

The SAPRC smog surrogate is designed to simulate the composition and reactivity of the current SCAB pollutant mix. Further, the concentrations studied in the program approximate the current range of non-methane hydrocarbons producing serious oxidant episodes, as well as those concentrations related to an across-the-board reduction in emissions. In order to obtain the maximum use of these data as a predictive tool, the surrogate results must be correlated with atmospheric data.

As a preliminary step for such a correlation, some monitoring station data have been examined for the purpose of exploring techniques for extracting useful information about details of the "initial" concentration conditions in current SCAB polluted atmospheres. Monitoring station data are unique in one respect; they represent the largest available collection of data taken over long periods on a daily basis. Other data, although often much more accurate, suffer the drawbacks of being insufficient statistical samples of random variables.

The data examined here consists of 6-9 A.M. concentrations (averaged over one hour) of total hydrocarbon and methane during 1973. The form of these data present a serious difficulty; they are given to the nearest ppmC (as methane). Aside from implications about their probable accuracy this means that any set of observations have an uncertainty of up to ± 1 ppmC for calculation of reactive hydrocarbon concentrations. This circumstance forces an indirect and inferential approach to an estimate of the concentration distribution for reactive hydrocarbon. The approach used is described as follows:

First, the hydrocarbon data from a given station was tested for self-consistency. The test consisted of analytically fitting total hydrocarbon vs. methane, both reduced by 1.45 ppmC (the worldwide background of methane), using a regression relationship passing through the origin. Serious non-random deviations of the class means of total hydrocarbon from the regression line were taken to indicate serious and systematic inaccuracies in concentration measurements at that station. Data from such stations is regarded as meaningless, at least

for 1973. In these calculations the best estimate of the true concentration corresponding to a data quote of 1 ppmC was taken as 1.45 ppmC because concentrations less than 1.45 ppmC are excluded as an impossibility.

Hydrocarbon data for 1973 from four LAAPCD stations, 001 (downtown L.A.), 083 (Pasadena), 060 (Azusa) and 075 (Pomona) were tested in this manner. The test indicated that hydrocarbon data from station 083 are untrustworthy. The most self-consistent data of the four sets are those obtained at station 001, which fitted the regression line quite closely. Data from this station were chosen to establish and exercise techniques of data treatment.

Since methane in excess of 1.4 ppmC can be assumed to originate from quite different sources than reactive hydrocarbons, correlation between the two variables can be assumed to be the result of atmospheric conditions. This assumption makes the distribution in concentration of methane an "index" of overall meteorological conditions at the station. This distribution for station 001 is shown in Figure 24 as a histogram in terms of relative frequency per ppmC. The histogram suggests a trial fit with an exponential distribution and the inset of Figure 24 shows the frequency data on a semilog plot along with a weighted least squares fit to the four higher concentration points of the five available. The point at the lowest concentration was regarded as untrustworthy because of its sensitivity to the estimate of background methane concentration. The exponential distribution represents the frequency data adequately even at low concentration.

If adequate representations of the distributions of total hydrocarbon can be found under the condition of constant methane, then an estimate may be made of the distribution of reactive hydrocarbon. This is based on the equation

$$g(u,v) = f(v) h(u;v)$$

where $g(u,v)$ is the joint distribution density of the random variables, u and v , and $h(u;v)$ is the conditional density of u given v . In this case v represents methane less the background concentration and u total hydrocarbon less the methane background. Since the best estimate of

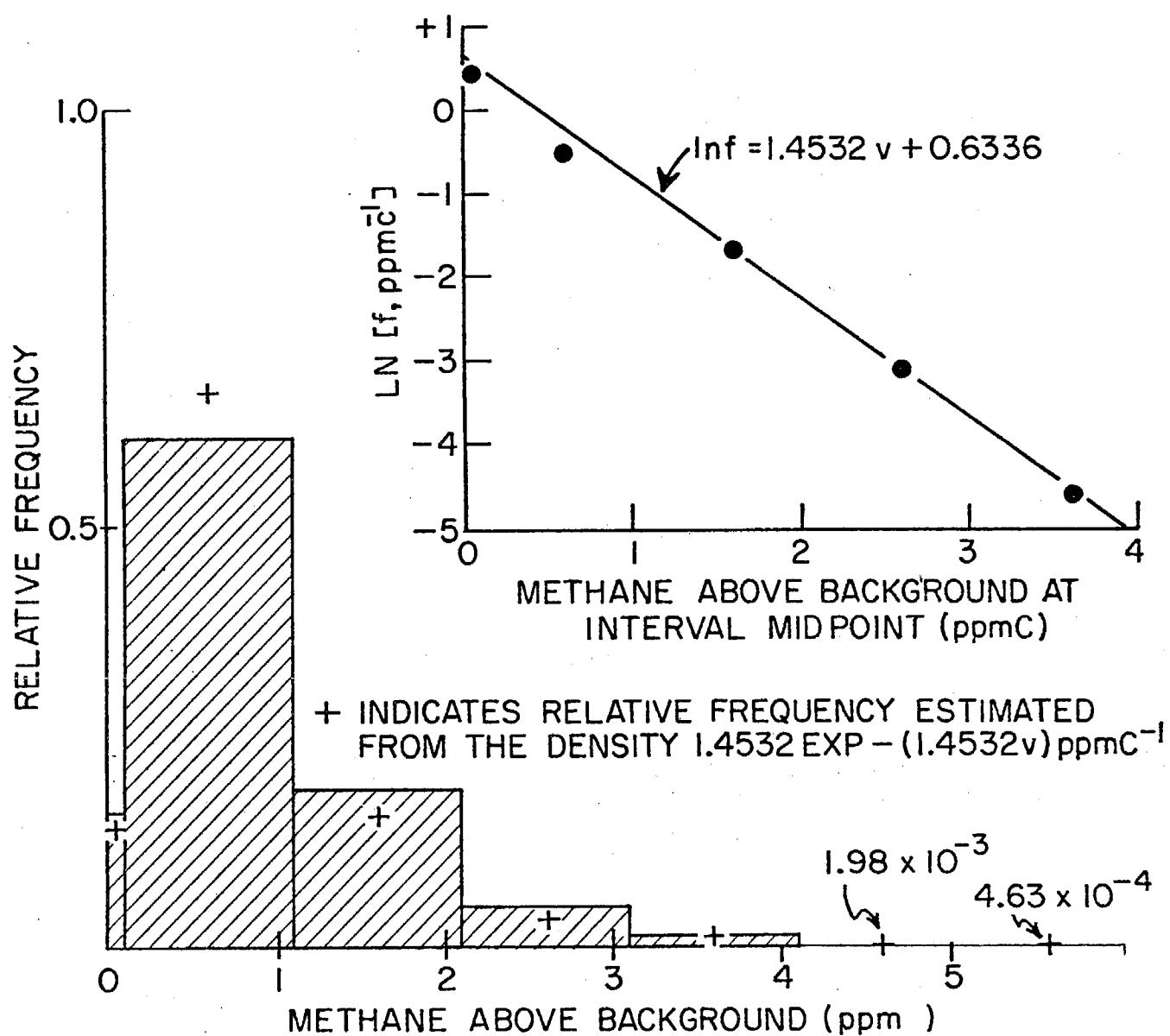


Figure 24. Frequency Data for 6-9 AM Methane Concentrations Observed at LAAPCD Station 001 During 1973

concentration of reactive hydrocarbon, x , from the given data is a linear combination of u and v ,

$$x = u - \beta v, \quad \beta > 1,$$

the distribution of x can be derived from the joint distribution of u and v by integrating overall accessible values of v , given x .

The data from station 001 were classified into groups of "constant" methane giving the histograms shown in Figure 25, each labeled with the corresponding midpoint concentration of methane in excess of 1.4 ppmC. The histogram for a methane concentration of 5 ppmC ($v = 3.6$) is inaccurate because the data represent a total of only eleven observations. Apparently as methane increases a "hole" in the probability density appears at lower concentrations of total hydrocarbon. The total hydrocarbon concentrations increase in the intervals just above the values for the fixed methane concentration. This phenomenon can be partially explained by hypothesizing that certain non-methane hydrocarbons are coemitted with methane and imposes the inequality condition.

$$u \geq (1 + \gamma)v, \quad 0 < \gamma < 1.$$

If all methane were emitted as natural gas then $\gamma \approx 0.2$. Figure 26 shows the exclusion results for $\gamma = 0.2$. It is apparent that both the probability of occurrence and the best value of u to represent a class interval can be markedly influenced by the imposition of such an inequality.

This reasonable hypothesis presents a new problem which can only be solved by arbitrary choices. A form for the conditional distribution of u can be assumed and the value of γ adjusted so as to obtain a reasonable fit of the corrected observed frequencies to the chosen form, or γ can be fixed at a reasonable value and a distribution fitted to the adjusted data. The coarse resolution of the data does not allow any clear choice of method.

One obvious choice for the conditional distribution is the simple exponential. Contemplation of Figures 25 and 26 indicates that it should be possible to adjust γ so as to fit this distribution.

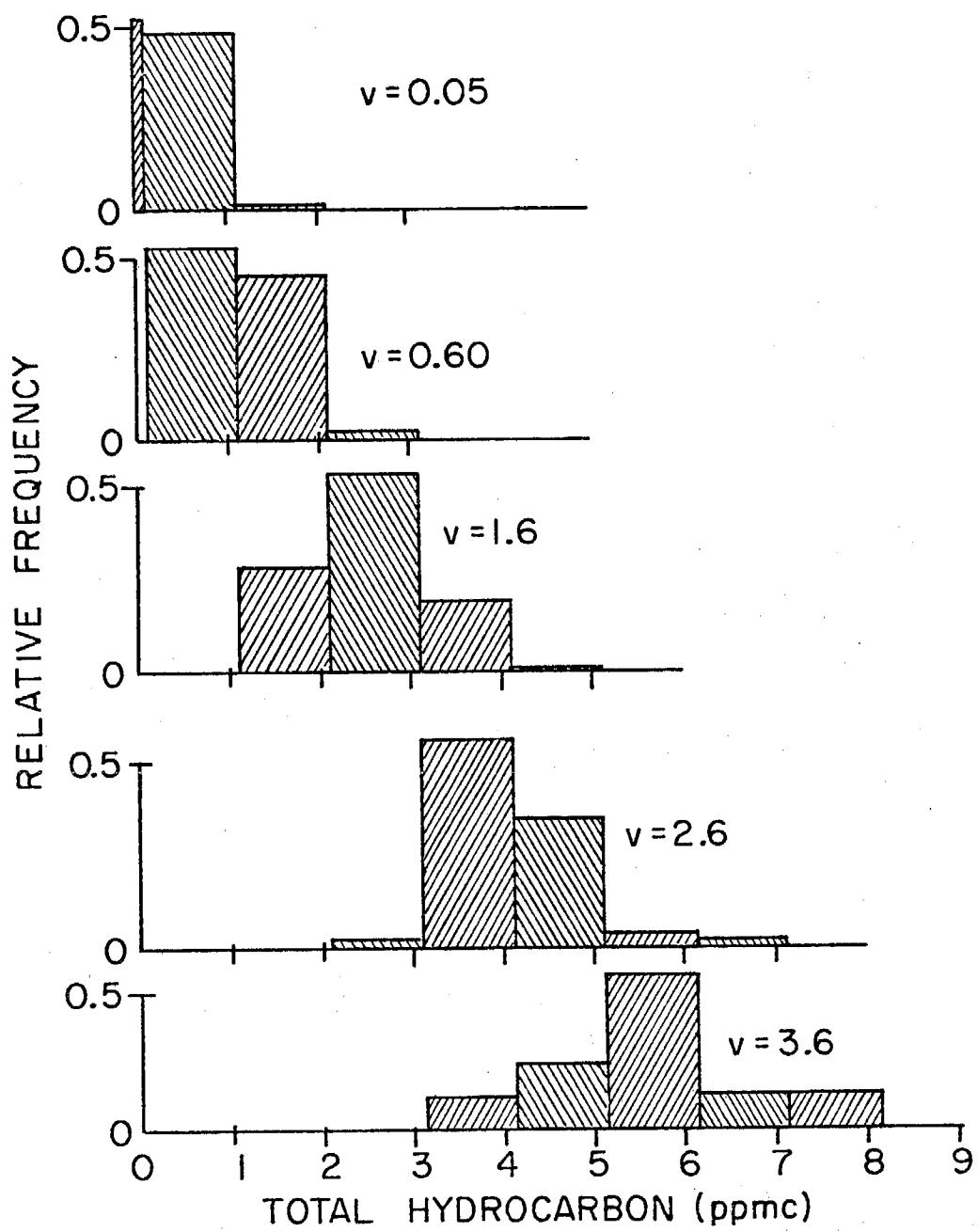


Figure 25. Relative Frequencies of Total Hydrocarbon for Constant Methane

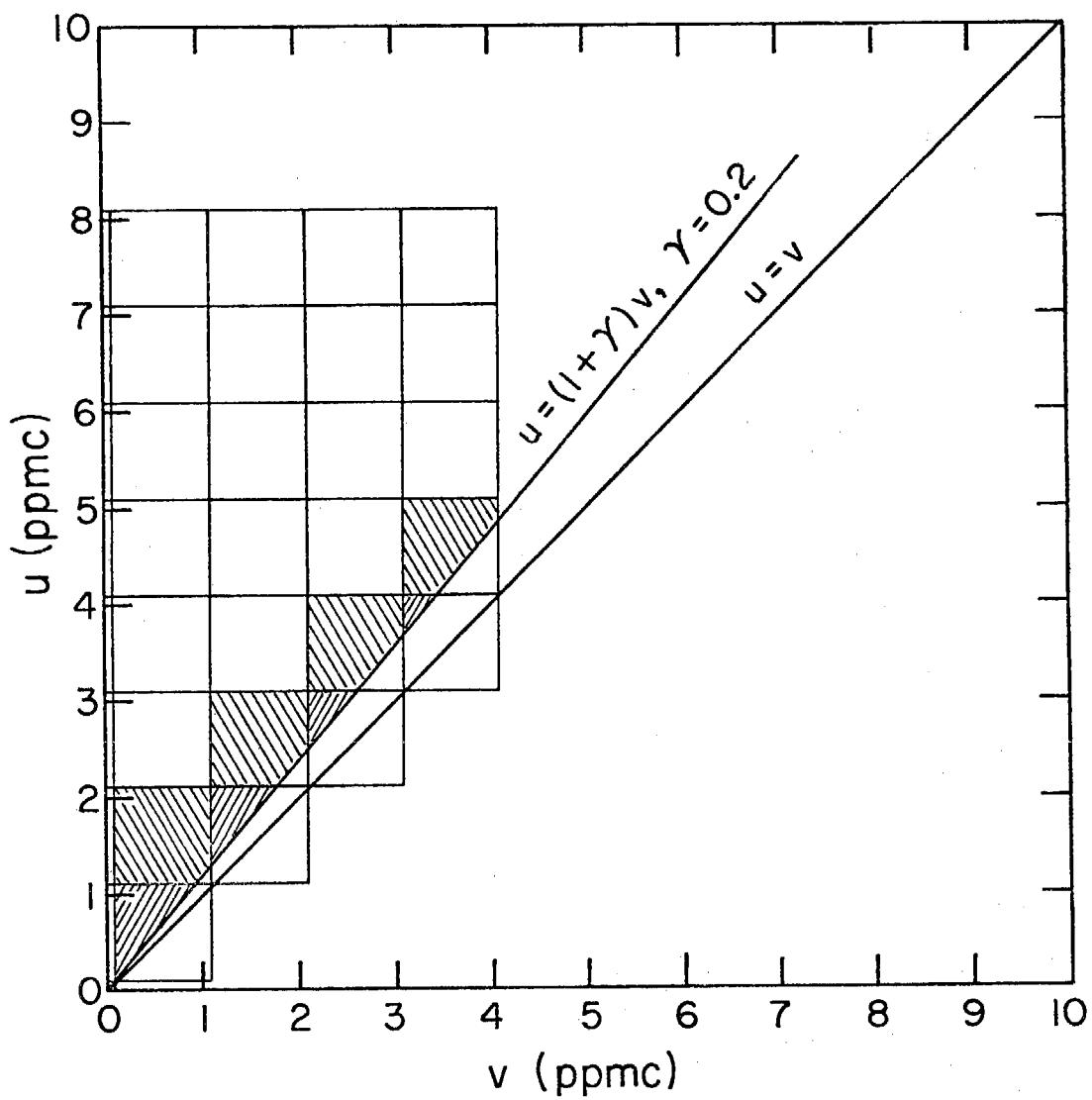


Figure 26. Illustration of Excluding Effect of Methane Co-Emissions on Conditional Distribution of Total Hydrocarbon

However, this would imply the unreasonable inference of high probability for low concentrations of hydrocarbons not correlated in emission with methane even when methane is at rather high concentration (indicating quite stagnant atmospheric conditions). It seems more reasonable that the conditional density function should approach zero at low emission-uncorrelated hydrocarbon concentration, except at methane concentrations approaching the background concentration where the distribution should approach the exponential. This reasoning suggests that we choose $\gamma = 0.2$, the best current estimate, and deal with the consequences.

Gamma distributions were chosen to fit the conditional distributions of reactive hydrocarbon because the limiting exponential distribution at low methane is the first member of this family of density functions. In addition, the gamma distribution is a two-parameter distribution having the requisite skewed shape and does not have the property of assigning finite densities to negative values of the random variable. The parameters for the gamma distribution were estimated from the sample means and variances of the conditional distributions. Estimation of these moments required careful adjustment of the raw data to partially compensate for the phenomena illustrated in Figure 26. Adjustments consisted of corrections to the nominal values of reactive hydrocarbon concentration assigned to the shaded two-dimensional intervals. This was done by applying the theorem of the mean for integral calculus to each square. The results along with estimates of means and variances are shown in Table 14. An upward trend in both means and variance with increasing methane is quite noticeable.

The gamma density can be expressed⁵⁵ by

$$f(z) = \frac{\alpha}{\Gamma(v)} (\alpha z)^{v-1} e^{-\alpha z}; v \geq 1, \alpha > 0.$$

The mean, variance and mode can be expressed in terms of the density parameters as v/α , v/α^2 and $(v-1)/\alpha$, respectively. This density becomes a simple exponential one for $v = 1$. However, can be expressed in terms of the first and second moments,

Table 14. Estimates of Class Interval Concentrations, Means, and Variances for Conditional Distributions of Reactive Hydrocarbons Obtained from LAAPCD Station 001 Data on Total Hydrocarbon and Methane at 6-9 A.M. during 1973.

Nominal conc. (ppmC)	Total CH ₄	HC	Observed Frequency	Representative Reactive HC conc. (ppmC)		Moment Estimates	
				Uncorrected	Corrected	Mean (ppmC)	Variance (ppmC ²)
0.05 (174)	0.05		0.5060	-0.01	+0.033	0.2948	0.08122
	0.60		0.4827	+0.54	0.54		
	1.60		0.0113	+1.54	1.54		
0.60 (661)	0.60		0.5276	-0.12	+0.327	0.6094	0.1098
	1.60		0.4511	+0.88	0.88		
	2.60		0.0214	+1.88	1.88		
1.60 (200)	1.60		0.2779	-0.32	+0.26	0.7992	0.2486
	2.60		.5252	+0.68	0.745		
	3.60		.1920	+1.68	1.68		
	4.60		.0049	+2.68	2.68		
2.60 (48)	2.60		0.0204	-0.52	+0.1933	1.0457	0.3929
	3.60		.5633	+0.48	0.6109		
	4.60		.3552	+1.48	1.48		
	5.60		.0407	+2.48	2.48		
	6.60		.0204	+3.48	3.48		
3.60 (11)	3.60		.09	-0.72			
	4.60		.18	+0.28			
	5.60		.55	+1.28			
	6.60		.09	+2.28			
	7.60		.09	+3.28			

$$\nu = \frac{\mu_1^2}{\sigma^2} .$$

Consequently, one test of the usefulness of the gamma distribution for the present problem is to check if the variation of the sample means and variances with excess methane is amenable to the hypothesis $\nu = 1$ at the background methane concentration. The estimates of these moments when plotted against mean excess methane suggest a linear dependence, as shown in Figure 27. This dependence seems reasonable by analogy with the behavior of conditional distributions of normally distributed correlated variables. Further, the possible intercept regions appear amenable to a limit of $\nu = 1$ at zero methane. The lines shown in Figure 27 are conditional least square fits for the limit $\nu = 1$ as $\nu \rightarrow 0$. The slopes and intercepts were obtained, using a Lagrange multiplier, λ , by minimizing the expression

$$\sum_i (y_i - A_1 - A_2 v_i)^2 + (z_i - B_1 - B_2 v_i)^2 + \lambda A_1^2 - B_1 ,$$

subject to the condition

$$A_1^2 - B_1 = 0.$$

Here, y represents means and z variances. The results in terms of gamma distribution parameters are

$$\alpha = 3.162 \frac{1 + 0.9292\nu}{1 + 1.0372\nu}$$

$$\nu = \frac{(1 + 0.0202\nu)^2}{1 + 1.0372\nu}$$

where accuracy is certainly less than suggested by the number of significant figures. Clearly, a hypotheses of constant α is not denied by the data since estimates of this parameter vary by less than 10% over a 5 ppmC range for excess methane. It is probable that the data are as reliably represented by the gamma distribution with a ν -independent

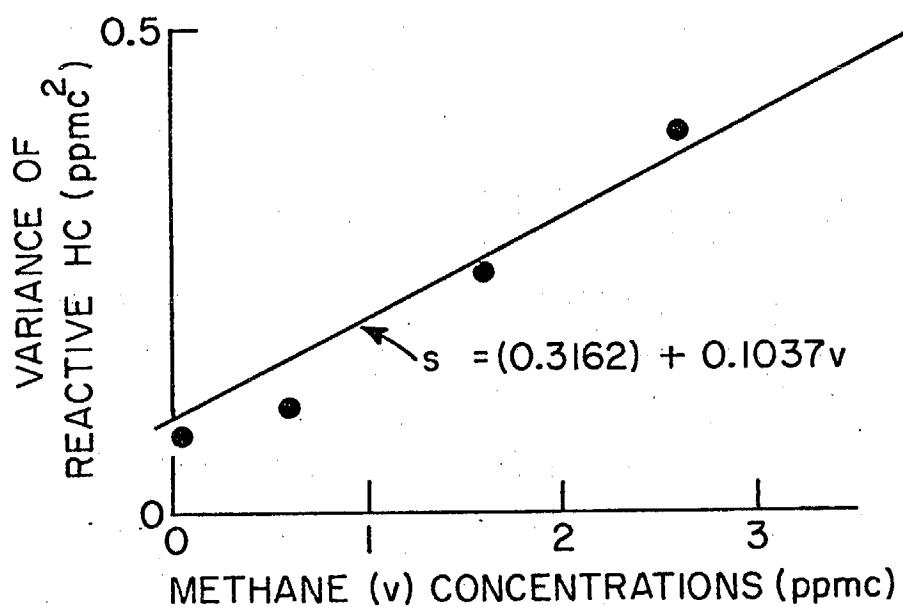
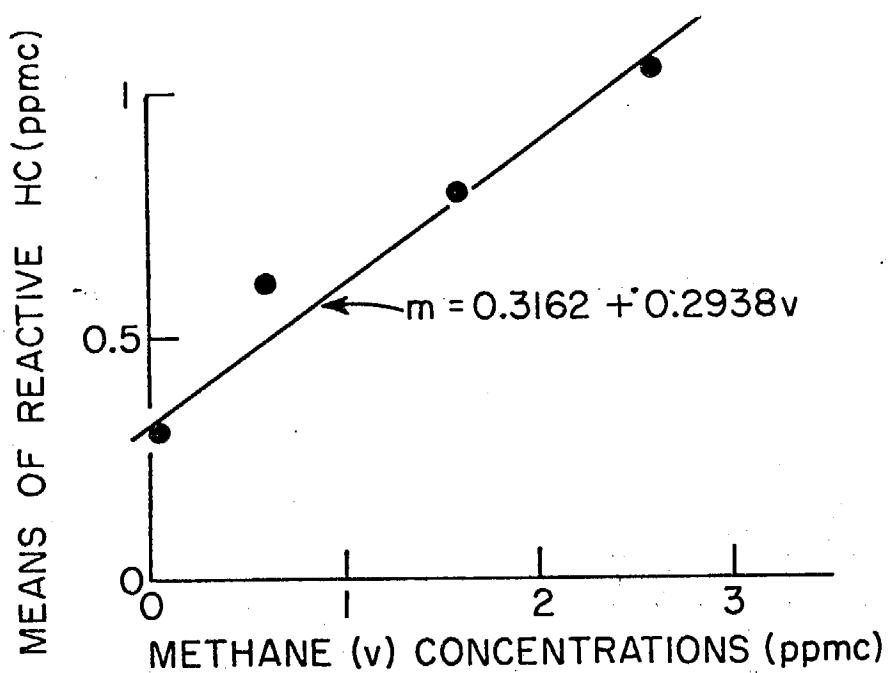


Figure 27. Sample Estimates of Moments of Conditional Distributions vs. Methane in Excess of Background at LAAPCD Station 001 at 6-9 AM during 1973

α -parameter and a v -parameter linearly dependent on v . Only more experience with similar data combined with confidence limit estimates for the parameters will confirm these and similar simplifying speculations.

These estimates of the conditional distribution of reactive hydrocarbon combined with the earlier estimate of the density of the methane distribution gives the joint distribution of methane and total hydrocarbon as a product of the two densities. Table 14 shows observed densities compared with densities calculated from the density product. The result is quite good considering that the density-estimating expression can be regarded as a first approximation. A single reprocessing of the data using computer techniques should adjust the empirical parameters to obtain a representation that is as accurate as the data. One area of uncertainty is the estimator for non-natural gas hydrocarbons. This estimate has marked effects on the estimation of observed densities in the first few intervals for each value of "constant" methane. A slight readjustment would bring the calculated and observed values into close agreement.

The intermediate goal for the type of calculation presented here is to obtain a good estimate of the frequency of occurrence of reactive hydrocarbon concentrations in the morning as observed by monitoring stations. This can be calculated from the joint distribution with methane by integration over all possible methane concentrations. The form of the joint density indicates considerable difficulty in carrying out an integration analytically, but suggests no fundamental difficulty for a numerical evaluation using a digital computer.

These initial calculations represent the first steps of an effort to make direct use of present and future SAPRC chamber data to predict the statistics of ground level ozone or oxidant (and other secondary pollutant) concentrations. Data from transport simulation chamber experiments are expected to be quite useful in estimating the influence of transport and diffusion on the "potential" oxidant (ozone) concentration distribution calculated from the joint distribution of 6-9 A.M. NO_x and NMHC concentrations. Reasonable and self-consistent assumptions about the dependence of distribution parameters on emission control

Table 15. Hydrocarbon Data from LAAAPCD Station 001 at 6-9 AM during 1973
 Showing Fit of Parametric Joint Distribution Densities to
 Observed Densities

Representative hydrocarbon conc. (ppmC) for each interval estimated				Estimated Interval Area (ppmC ²)	Estimated Observed Densities (ppmC ⁻²)	Calculated Densities
CH ₄ v	Total u	Reactive u-1.2v	Observed Frequency			
0.05	0.05	0.033	0.0803	0.0500	1.606	3.5453
	0.6	0.54	0.0766	0.1000	0.766	0.8140
	1.6	1.54	0.0018	0.1000	0.018	0.0367
0.60	0.6	0.33	0.3186	0.4002	0.7961	0.7253
	1.6	0.88	0.2724	0.9798	0.2780	0.3035
	2.6	1.88	0.0129	1.0000	0.0129	0.0270
1.60	1.60	0.26	0.0508	0.2535	0.2004	0.1385
	2.60	0.74	0.0960	0.9265	0.1036	0.1068
	3.60	1.68	0.0351	1.0000	0.0351	0.0164
	4.60	2.68	0.0009	1.0000	0.0009	0.0014
2.60	2.60	0.19	0.0009	0.1402	0.0064	0.0102
	3.60	0.61	0.0249	0.9168	0.0272	0.0269
	4.60	1.48	0.0157	1.0000	0.0157	0.0113
	5.60	2.48	0.0018	1.0000	0.0018	0.0016
	6.60	3.48	0.0009	1.0000	0.0009	0.0002
3.60	3.60	-	0.0009	0.0602	0.0150	-
	4.60	-	0.0018	0.7198	0.0025	-
	5.60	1.28	0.0055	1.0000	0.0055	0.0029
	6.60	2.28	0.0009	1.0000	0.0009	0.0003
	7.60	3.28	0.0009	1.0000	0.0009	0.00001

efforts will then allow predictions about future controlled atmospheres in terms of the frequency of violation of ambient air quality standards.

E. A Study of the Relative Rates of Reaction of the Hydroxyl Radical with Aromatic Hydrocarbons

Background. In recent years, a substantial body of kinetic data has been obtained for atmospherically important⁵⁶⁻⁵⁹ reactions of the hydroxyl radical (OH) which has now been detected in ambient air for the first time.⁶⁰ A critical need remains, however, for kinetic and mechanistic data for the reactions of OH with aromatic compounds in the gas phase.⁶¹⁻⁶³ This is apparent not only from the standpoint of the need to develop validated kinetic mechanisms of photochemical smog formation,⁶⁴⁻⁶⁷ but also with respect to the increased use of aromatic compounds in unleaded gasoline⁶⁸ and the resultant increase in ambient concentration of aromatics^{69,70} over those already present due to the use of solvents.⁷¹ Employing the SAPRC all-glass chamber we have now measured, under ambient conditions and at fractional part per million concentrations, the rates of disappearance of eight aromatic compounds which, under the assumptions detailed below, we ascribe to reaction with OH.⁷²

Experimental Methods. A special surrogate mixture based on the standard surrogate described in Section I-B (pages 5-6), but rich in aromatic hydrocarbons, was developed for this study. The detailed composition of the special hydrocarbon mixture is given in Table 16. Initial concentrations in the photolysis experiments were essentially those of the standard surrogate mixture, i.e., ~2400 ppbC of total non-methane hydrocarbons, ~0.32 ppm NO_x, 7.0 ppm of CO and 2.8 ppm of CH₄ (see data sheets for Runs 70-H and 71-H in Appendices A and C). The Reactivity of this aromatic-rich surrogate was approximately the same as that of the standard surrogate as may be seen by comparison with Run 49-G. The hydrocarbon data used in the following analysis were corrected for losses due to sampling from the chamber (~3.8% for two hours).

Results and Discussion. Figure 28 shows the rates of disappearance observed for seven aromatic compounds and n-butane during a two-hour run. With the exception of benzene, the rates of disappearance for the aromatic compounds were sufficiently large to permit the calculation

Table 16. Composition of Hydrocarbon Mixture Employed in the Special Aromatic-Rich Surrogate

Compound	Concentration (ppb in air)
Ethylene	50
Ethane	95
Acetylene	55
Propane	15
Propene	12
n-Butane	205
cis-2-Butene	15
Benzene	25
Toluene	20
p-Xylene	17
m-Xylene	17
o-Xylene	14
1,3,5-Trimethylbenzene	13
1,2,4-Trimethylbenzene	9
1,2,3-Trimethylbenzene	9

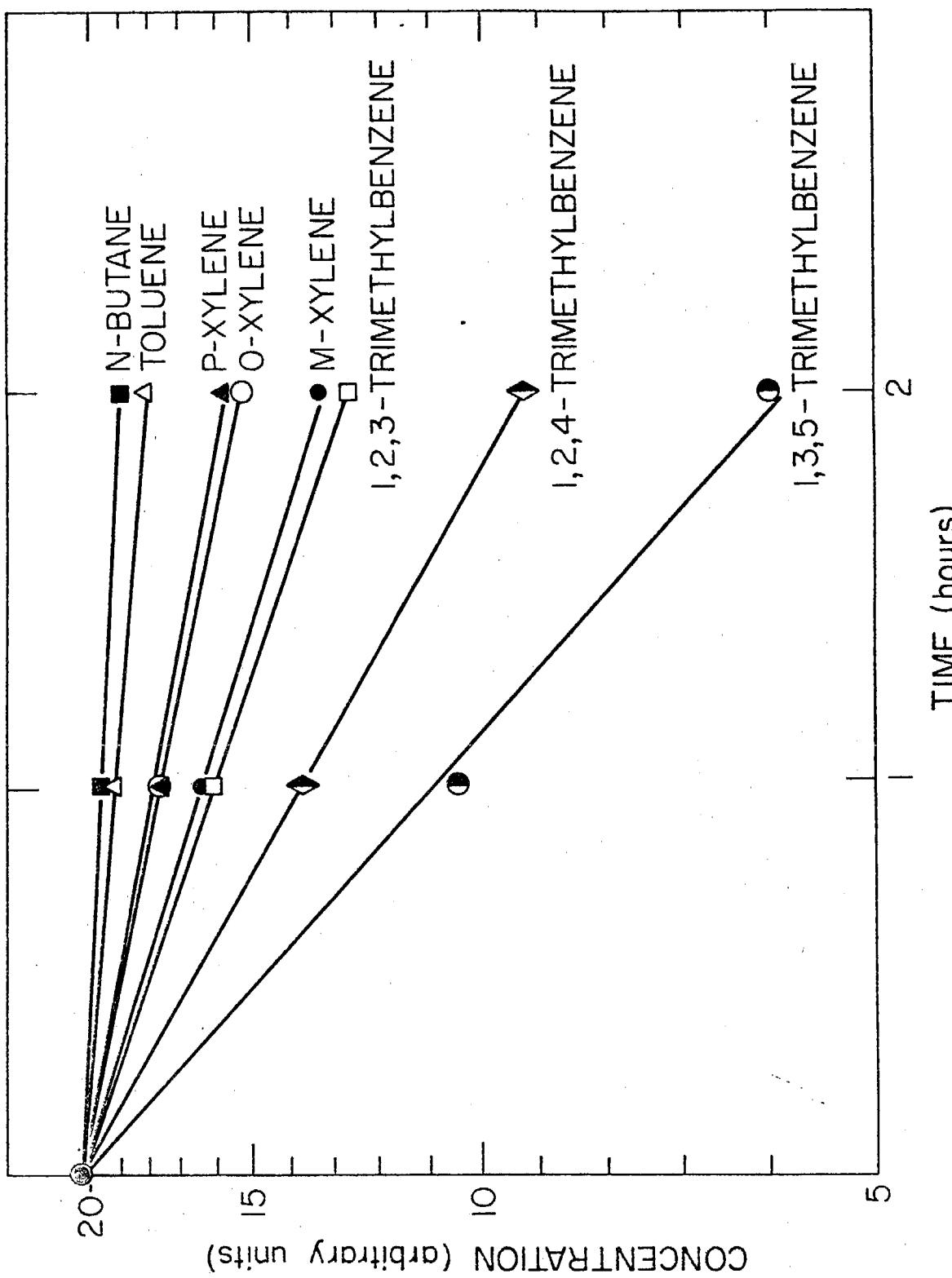


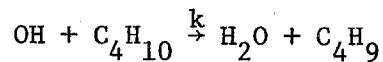
Figure 28. Hydrocarbon Disappearance during Two-Hour Photolysis of HC- NO_x Mixture in Air in the Glass Chamber at $304 \pm 1^\circ\text{K}$ and 1 atm Pressure. Initial Concentrations Have Been Normalized to 20 ppb, the Experimental Value for Toluene.

of a series of relative rate constants normalized to n-butane. Table 17 shows the results of these calculations based on data from Runs 70-H and 71-H. In these experiments, the rate of disappearance of benzene was so close to the rate expected solely due to sampling losses, that it is only possible to give an upper limit for its disappearance in this system. Within the experimental uncertainties given, the relative reactivities are in good agreement with those obtained previously by Kopczynski based on percent of aromatic hydrocarbon consumed in the first hour of irradiation with nitrogen oxides.⁷³

Morris and Niki⁷⁴ have shown that the rate of loss of alkanes, aldehydes and aromatic hydrocarbons measured in smog chamber studies correlate better with OH rather than with O(³P) atom rate constants for each hydrocarbon. In addition, in our computer modeling studies⁷⁵ of a propylene-NO-NO₂ mixture in air, OH is predicted to be the most important intermediate species in the depletion of propylene during the initial stages of a smog chamber experiment. This is illustrated in Figure 29 which shows the relative contribution to attack on propylene by species such as OH, O₃, HO₂ and O(³P) atoms. Similar conclusions have been reached in previous modeling studies.⁶⁴⁻⁶⁶ Consequently, our standard 6-hour chamber irradiations were shortened to two hours since, as shown in Figure 29, in the late stages of reaction O(³P), HO₂ and particularly O₃ assume increasing importance relative to OH.⁶⁵

In addition to the above, it is known that HO₂ and O₃ react slowly with alkanes^{76,77} and that O₃ is much less reactive⁷⁶ towards aromatic compounds than towards olefins.⁷⁸ Thus O₃ will be less important for aromatic compounds and alkanes than shown in Figure 28, which applies to propylene. Taken together, these observations strongly suggest that OH is the most important species early in the photolysis. Thus, in order to obtain rate constants we have made the reasonable assumption (based on all data available to us) that OH is the species largely responsible for depleting the hydrocarbons in the early portion (i.e., the first two hours) of the usual six-hour photolysis experiments.

Rate constants may be derived from the results given in Table 16 by using a mean value of 1.8×10^9 mole⁻¹ s⁻¹ at 298°K for the reaction



obtained from the published^{74,79-81} values of k and by making the assumption that the major hydrocarbon loss process is via reaction with OH. These rate constants are given in Table 18.

Comparison of the rate constants derived from the chamber data with absolute values obtained subsequently in our laboratories using a flash photolysis-resonance fluorescence technique for generation and detection of OH radicals⁸² is also given in Table 18. The excellent agreement indicates the validity of the assumption that the OH radical is indeed responsible for the reactivity of aromatic hydrocarbons in the early portion of the smog chamber irradiation.

Significantly, the absolute OH radical rate constants for m-xylene and the trimethylbenzenes are as large as those reported for OH + propylene^{74,83,84} of about $1 \times 10^{10} \text{ } \mu\text{mol}^{-1} \text{ s}^{-1}$. This is in good agreement with smog chamber results which have indicated that the highly substituted benzenes have a reactivity in photochemical smog formation equal to that of the alkenes.^{71,73}

Application to Ambient Air. Table 19 shows the average concentrations of a series of hydrocarbons at downtown Los Angeles⁸⁵ or at Riverside. Approximate values for the rates of disappearance of these compounds in the atmosphere can be calculated from these rates using an assumed atmospheric OH concentration of $10^7 \text{ radicals cm}^{-3}$ (which is entirely consistent both with previous estimates^{60,65,86} and with this work) and combining this value with the present and published OH rate constant data. Two parameters are given in Table 18 - the disappearance rate relative to methane, i.e., $d(\text{HC})/dt$, and the half-life $\tau_{1/2} = 0.693/k(\text{OH})$. From these results it can be seen that propylene, often employed in smog chamber studies to mimic the complex ambient hydrocarbon mix, disappears rapidly as expected but that several other compounds such as n-butane, toluene and particularly m-xylene have comparable disappearance rates. Although these calculations are based on the kinetic data for OH alone, they indicate that the chemical compounds investigated here can play a significant role in atmospheric chemistry.

Table 17. Rates of Disappearance of the Selected Aromatic Compounds Relative to n-Butane at One Atmosphere in Air and $304 \pm 1^\circ\text{K}$

Compound	Relative Rate of Disappearance
n-Butane	1
Benzene	≤ 1
Toluene	1.4 ± 0.6
o-Xylene	4.3 ± 1.3
m-Xylene	7.5 ± 0.5
p-Xylene	4.1 ± 0.9
1,2,3-Trimethylbenzene	7.6 ± 1.6
1,2,4-Trimethylbenzene	11 ± 2
1,3,5-Trimethylbenzene	17 ± 2

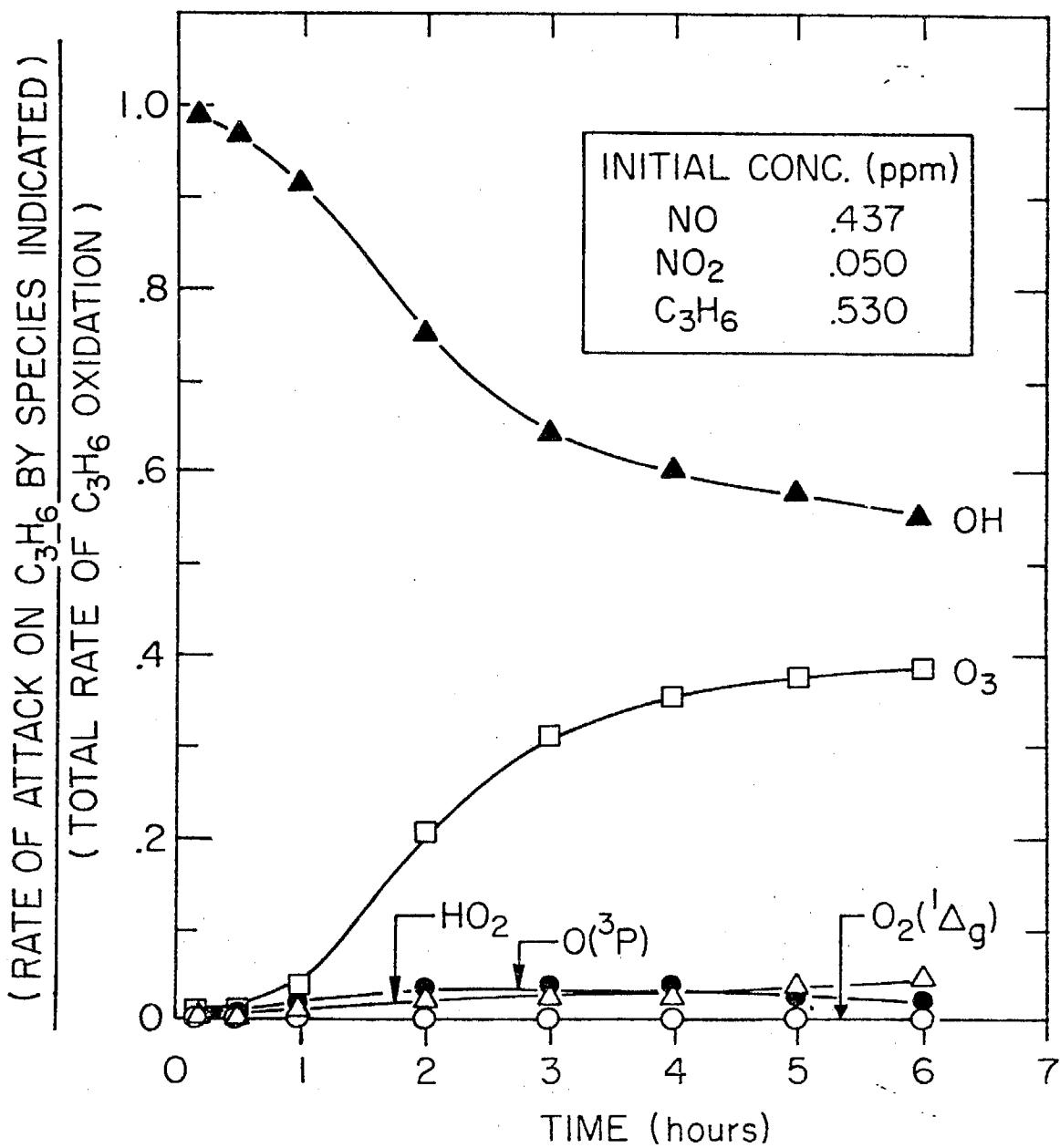


Figure 29. Predicted Relative Importance of Several Reactive Intermediates during Photooxidation of Propylene (Utilizing Mechanism from Ref. 65).

Table 18. Room Temperature Rate Constants for the Reaction of OH Radicals with n-Butane and Aromatic Hydrocarbons Obtained from Chamber Experiments and Comparison with Those Obtained by a Flash Photolysis-Resonance Fluorescence Method

Compound	$k (\text{dmole}^{-1} \text{ sec}^{-1}) \times 10^{-9}$	
	This Work ^a	Reference 82 ^b
n-Butane	1.8 \pm 0.5	
Benzene	\leq 3	.747 \pm .072
Toluene	2.5 \pm 0.9	3.48 \pm .35
o-Xylene	7.7 \pm 2.3	9.22 \pm .90
m-Xylene	14 \pm 1	14.2 \pm 1.4
p-Xylene	7.4 \pm 1.5	7.35 \pm .72
1,2,3-Trimethylbenzene	14 \pm 3	15.9 \pm 1.6
1,2,4-Trimethylbenzene	20 \pm 3	20.2 \pm 2.0
1,3,5-Trimethylbenzene	31 \pm 4	28.4 \pm 2.9

^aPlaced on an absolute basis using the mean of the literature values for the rate constant for OH + n-butane from references 73, 78, 79 and 80; total pressure 1 atmosphere air.

^bTotal pressure \geq 50 torr (Ar).

Table 19. Calculated Rates of Disappearance of Selected Hydrocarbons in Ambient Air Based on Reaction with OH Radicals at $\sim 300^\circ\text{K}$

Compound (HC)	Ambient Concentration in L.A. Basin pphm	mol. ℓ^{-1}	Rate Constant ($k_{\text{OH}+\text{HC}}$) ($\ell \text{ mol}^{-1} \text{s}^{-1}$)	Initial Relative Disappearance Rate ^c	Half Life $\tau_{1/2}$
Methane	199 ^a	8.1×10^{-8}	5×10^6 ^d	1.0	96.6 days
Ethane	4.8 ^a	2.0×10^{-9}	1.8×10^8 ^d	0.9	2.7 days
n-Butane	3.0 ^a	1.2×10^{-9}	1.8×10^9	4.2	6.5 hours
Propylene	1.1 ^a	4.5×10^{-10}	1×10^{10} ^d	11.0	1.2 hours
Acetylene	7.7 ^a	3.1×10^{-9}	5.3×10^8 ^e	4.1	19 hours
Benzene	2.2 ^a	9.0×10^{-10}	$\leq 2.3 \times 10^9$	≤ 5.1	≥ 5.1 hours
Toluene	2.4 ^a	9.8×10^{-10}	2.5×10^9	6.0	4.6 hours
m-Xylene	0.50 ^b	2.0×10^{-10}	1.4×10^{10}	7.0	0.83 hours
1,2,4-Trimethyl- benzene	0.20 ^b	8.1×10^{-11}	2.0×10^{10}	4.0	0.58 hours

^aReference 85. Data were taken at downtown Los Angeles between March and August, 1973.

^bData taken at UCR in September, 1974.

^cThe relative disappearance rate is the initial hydrocarbon (HC) disappearance rate, $-\frac{d[\text{HC}]}{dt} = k[\text{OH}][\text{HC}]$, normalized to methane.

^dReference 87

^eReference 88

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VII. GLOSSARY

ARB	- Air Resources Board, State of California
cfm	- cubic feet per minute
CH ₄	- methane
CO	- carbon monoxide
EPA	- Environmental Protection Agency
GC	- gas chromatography
HC	- hydrocarbon
HNO ₃	- nitric acid
KI	- potassium iodide
LPO	- low pressure oxygen
NMHC	- nonmethane hydrocarbon
NO	- nitric oxide
NO ₂	- nitrogen dioxide
NO _x	- oxides of nitrogen, sum of nitric oxide and nitrogen dioxide
O ₃	- ozone
oxidant	- Oxidant is the collective name for those pollutants which are capable of oxidizing aqueous iodide ion to molecular iodine. The principal components of photochemical oxidant are ozone, nitrogen dioxide, and peroxyacetyl nitrate (PAN). The various components of oxidant do not all oxidize the iodide ion to molecular iodine with the same efficiency. O ₃ is 100% efficient, while NO ₂ and PAN are about 15% efficient. SO ₂ is 100% efficient for the reduction of molecular iodine to the iodine ion. Thus, it acts as an interference and lowers oxidant readings.
oxides of nitrogen	- sum of nitric oxide and nitrogen dioxide
PAN	- peroxyacetyl nitrate
ppb	- parts per billion

ppbC	- parts per billion carbon
ppm	- parts per million
ppmC	- parts per million carbon
reactive HC	- Historically air pollution control agencies and atmospheric scientists have employed a large number of different schemes for classifying hydrocarbons either into graded (numbered) classes or into classes designated as "high reactive," "low reactive," "nonreactive," etc. At present there is still no universally accepted definition of what constitutes the body of reactive hydrocarbons. SAPRC researchers for the most part have taken the view that, given sufficiently long irradiation times--i.e., midsummer days or even multiple day irradiations of stagnant air masses--the only hydrocarbon which can be considered truly non-reactive is methane.
RH	- relative humidity
SAPRC	- Statewide Air Pollution Research Center, University of California, Riverside
SCAB	- South Coast Air Basin
UV	- ultraviolet

APPENDIX A**Inorganic Data for Surrogate Runs 10-C through 73-G**

SURROGATE RUN 10-C
GLASS CHAMBER
1973 JULY 9

LIGHTS ON 1130, OFF 1730 INTENSITY = 0.70 CF MAXIMUM
 INITIAL RH = 75% /23.94 DEG C/ FINAL RH (NOT MEASURED)
 CASPI FATOR 1.02, MAST FACTOR 1.8
 AT T = 0: SURROGATE HC = 1810 PPB; TOTAL NON-METHANE HC = 1924 PPB;
 METHANE = 2560 PPB

CLOCK	FLAPS/FD	OZONE	OXIDANT	NO	NO ₂ -PAN	NO _x -PAN	C ₂	PAN	HCHO	WALL T	03*NO	TOT N
TIME	TIME (WIN)	(PPM)	(PPM)	(PPM)	(PPM)	(PPM)	(PPM)	(PPM)	(PPM)	(DEG C)	/NO ₂	(PPM)
1130	0.	0.0	0.0	C.320	0.035	0.343	4.9	0.0	*****	24.24	0.0	0.355
1145	15.	0.0	0.0	0.305	0.057	0.360	*****	*****	*****	26.10	0.0	0.362
1200	36.	0.002	0.007	0.238	0.118	0.352	*****	*****	*****	27.64	0.004	0.358
1215	45.	0.005	0.013	0.164	0.177	0.341	*****	*****	*****	28.85	0.005	0.342
1230	60.	0.017	0.036	0.112	0.221	0.332	*****	*****	*****	29.83	0.009	0.334
1245	75.	0.035	0.054	0.072	0.242	0.314	*****	*****	*****	30.61	0.010	0.317
1300	90.	0.053	0.072	0.049	0.249	0.302	*****	*****	*****	31.10	0.010	0.304
1315	105.	0.080	0.083	0.035	0.252	0.285	*****	*****	*****	31.59	0.011	0.294
1330	120.	0.103	0.106	0.026	0.247	0.273	*****	*****	*****	31.91	0.011	0.282
1345	135.	0.125	0.117	0.024	0.241	0.264	*****	*****	*****	32.19	0.012	0.275
1355	145.	*****	*****	*****	*****	*****	*****	*****	*****	0.161	*****	*****
1400	150.	0.137	0.140	0.024	0.238	0.257	*****	*****	*****	32.42	0.014	0.272
1430	180.	0.186	0.180	0.019	0.225	0.240	*****	*****	*****	32.76	0.016	0.256
1500	210.	0.222	0.212	0.017	0.210	0.224	*****	*****	*****	32.97	0.018	0.241
1520	240.	0.268	0.238	0.014	0.195	0.208	*****	*****	*****	33.15	0.020	0.227
1555	265.	*****	*****	*****	*****	*****	*****	*****	*****	0.204	*****	*****
1600	270.	0.311	0.272	0.014	0.177	0.190	*****	*****	*****	33.25	0.025	0.210
1630	300.	0.356	0.310	0.014	0.165	0.178	*****	*****	*****	33.23	0.031	0.192
1707	337.	0.413	0.362	0.014	0.143	0.155	*****	*****	*****	33.27	0.042	0.180
1730	360.	0.447	0.391	0.014	0.132	0.144	*****	*****	*****	33.25	0.049	0.172
1747	377.	*****	*****	*****	*****	*****	*****	*****	*****	0.323	*****	*****

***** NF DATA TAKEN --- DATA DISCARDED

? QUESTIONABLE DATA

3274F 360.0 MIN TOTAL DOSAGE = 68.46 PPM-MIN
 NC 360.0 MIN TOTAL DOSAGE = 21.34 PPM-MIN
 NO₂-PAN 360.0 MIN TOTAL DOSAGE = 68.20 PPM-MIN
 PAN 360.0 MIN TOTAL DOSAGE = 4.29 PPM-MIN
 OZONE DOSAGE GT 0.10 = 41.04 PPM-MIN
 GLCNE DOSAGE GT 0.08 = 46.01 PPM-MIN
 NO₂-PAN DOSAGE GT 0.25 = 0.03 PPM-MIN

SURROGATE RUN 11-C
GLASS CHAMBER
1973 JULY 10

LIGHTS ON 1132, OFF 1730 INTENSITY = 0.70 CF MAXIMUM
INITIAL PH = 7.5 (23.55 DEG C) FINAL RH (NOT RECORDED)
CASTIBI FACTOR 1.02, MAST FACTOR 1.8
ATT = 0; SURROGATE HC = 1868 PPBC; TOTAL NON-METHANE HC = 1970 PPBC;
METHANE = 2320 PPB

CLOCK	ELAPSED TIME	OZONF (PPM)	OXIDANT (PPM)	NO (PPM)	NO _x -PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	03*NO /NO ₂	TOT N (PPB)
1132	0.	0.0	0.0	0.0	0.413	0.025	0.434	4.9	0.0	0.074	24.11
1145	13.	0.0	0.009	0.004	0.436	0.037	0.436	*****	*****	*****	25.34
1203	26.	0.0	0.039	0.368	0.066	0.432	0.427	*****	*****	*****	20.95
1215	43.	0.0	0.014	0.313	0.109	0.424	0.424	*****	*****	*****	28.50
1220	58.	0.0	0.023	0.270	0.156	0.410	0.410	*****	*****	*****	29.60
1245	73.	0.0	0.034	0.217	0.192	0.403	0.403	*****	*****	*****	30.35
1300	88.	0.006	0.036	0.175	0.227	0.391	0.391	*****	*****	*****	30.89
1315	103.	0.011	0.047	0.139	0.252	0.391	0.391	*****	*****	*****	31.29
1320	118.	0.020	0.056	0.109	0.273	0.383	0.383	*****	*****	*****	31.64
1342	130.	*****	*****	*****	0.297	0.366	0.366	*****	*****	0.175	*****
1400	148.	0.039	0.070	0.068	0.293	0.349	0.349	*****	*****	*****	32.23
1430	178.	0.065	0.088	0.044	0.301	0.329	0.329	*****	*****	*****	32.61
1500	208.	0.097	0.117	0.036	0.298	0.315	0.315	*****	*****	*****	34.84
1531	239.	0.125	0.149	0.028	0.285	0.316	0.316	*****	*****	*****	33.03
1600	266.	0.156	0.176	0.019	0.276	0.297	0.297	*****	*****	*****	33.14
1630	298.	0.188	0.202	0.017	0.265	0.282	0.282	*****	*****	0.011	0.293
1700	328.	0.228	0.239	0.017	0.251	0.268	0.268	*****	*****	*****	33.32
1730	358.	0.261	0.265	0.239	0.255	0.255	0.255	*****	*****	0.012	33.32
1750	376.	*****	*****	*****	*****	*****	*****	*****	*****	0.291	*****

***** NO DATA TAKEN ----- DATA DISCARDED ? QUESTIONABLE DATA

OZONF 353.0 MIN TOTAL DOSAGE = 31.56 PPM-MIN
NC 328.0 MIN TOTAL DOSAGE = 39.75 PPM-MIN
NO_x-PAN 358.0 MIN TOTAL DOSAGE = 84.73 PPM-MIN
PAN 358.0 MIN TOTAL DOSAGE = 1.99 PPM-MIN
OZONE DOSAGE GT 0.10 = 11.32 PPM-MIN
OZONE DOSAGE GT 0.08 = 14.02 PPM-MIN
NO_x-PAN DOSAGE GT 0.25 = 7.11 PPM-MIN

SURROGATE PUN 12-C
GLASS CHAMBER
1973 JULY 11

LIGHTS ON 1135 OFF 1736 INTENSITY = 0.70 CF MAXIMUM
INITIAL RH = 70 % (23.97 DEG C) FINAL RH = 25 % (25.47 DEG C)
CALIBRATION FACTOR ESTIMATED
CSTB1 FACTOR 1.02, MAST FACTOR 1.8
AT T = 0: SURROGATE HC = 1866 PPBC; TOTAL NCN-METHANE HC = 1981 PPBC;
METHANE = 2420 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	03*NO /NO2	TOT N (PPM)
1135	0.	0.0	0.0	0.420	0.018	0.434	5.0	0.0	0.090	24.00	0.0	0.438
1153	18.	0.0	0.0	0.388	0.048	0.431	*****	*****	*****	26.48	0.0	0.436
1205	30.	0.0	0.0	0.356	0.078	0.431	*****	*****	*****	27.73	0.0	0.434
1225	50.	0.0	0.0	0.290	0.131	0.421	*****	*****	*****	29.26	0.0	0.421
1235	60.	0.0	0.0	0.007	0.263	0.157	0.420	0.0	0.0	29.84	0.0	0.426
1250	75.	0.005	0.016	0.217	0.197	0.414	*****	*****	*****	30.55	0.006	0.415
1305	90.	0.008	0.031	0.174	0.230	0.404	*****	*****	*****	31.10	0.006	0.406
1320	105.	0.013	0.036	0.138	0.255	0.396	*****	*****	*****	31.52	0.007	0.395
1335	120.	0.018	0.049	0.113	0.271	0.385	*****	*****	*****	31.77	0.008	0.386
1405	150.	0.036	0.065	0.074	0.293	0.370	*****	*****	*****	32.17	0.009	0.371
1435	160.	0.061	0.081	0.048	0.301	0.356	*****	*****	*****	32.52	0.010	0.353
1512	217.	0.098	0.112	0.032	0.304	0.336	*****	*****	*****	32.82	0.010	0.342
1537	242.	0.124	0.126	0.026	0.295	0.325	*****	*****	*****	32.98	0.011	0.331
1605	270.	0.156	0.023	0.285	0.275	0.294	*****	*****	*****	33.14	0.012	0.316
1635	300.	0.189	0.176	0.018	0.275	0.294	*****	*****	*****	33.22	0.012	0.301
1705	350.	0.225	0.225	0.018	0.259	0.275	*****	*****	*****	33.25	0.016	0.287
1735	360.	0.263	0.248	0.016	0.245	0.260	4.7	0.010	0.010	33.26	0.017	0.271
1802	387.	0.287	0.287	0.016	0.245	0.260	*****	*****	*****	0.292	*****	0.271

***** NO DATA TAKEN ---- DATA DISCARDED

? QUESTIONABLE DATA

OZONE	360.0	MIN TOTAL DOSAGE = 31.16 PPM-MIN
NO	360.0	MIN TOTAL DOSAGE = 40.93 PPM-MIN
NO2-PAN	360.0	MIN TOTAL DOSAGE = 86.59 PPM-MIN
PAN	360.0	MIN TOTAL DOSAGE = 1.59 PPM-MIN
OZONE DOSAGE GT	0.10	11.14 PPM-MIN
OZONE DOSAGE GT	0.08	14.31 PPM-MIN
NO2-PAN DOSAGE GT	0.25	8.52 PPM-MIN

SURROGATE RUN 13-C
GLASS CHAMBER

1973 JULY 12

LIGHTS ON 1100, OFF 1700 INTENSITY = 0.70 CF MAXIMUM
 INITIAL RH = 71 ± 123.0% (DEG C) FINAL RH (NOT RECORDED)
 CC CALIBRATION FACTOR ESTIMATED
 DASIBI FACTOR 1.02, WAST FACTOR 1.8
 AT T = C: SURROGATE HC = 1577 PPBC; TOTAL NCN-METHANE HC = 2096 PPBC;
 METHANE = 254C PPBC

CLOCK	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	03*NO (PPM)	TOT N /NO2 (PPM)
1100	0.	0.0	0.0	0.0	0.184	0.028	0.200	4.9	0.0	0.089	23.55
1116	16.	0.0	0.0	0.0	0.137	0.067	0.197	*****	*****	25.15	0.0
1130	30.	0.005	0.0	0.0	0.108	0.090	0.194	*****	0.0	26.64	0.006
1149	49.	0.032	0.023	0.0	0.040	0.147	0.183	*****	*****	28.10	0.009
1200	60.	0.051	0.045	0.0	0.026	0.153	0.176	*****	0.003	28.76	0.009
1219	75.	0.089	0.076	0.016	0.155	0.166	0.166	*****	*****	29.50	0.009
1230	90.	0.108	0.097	0.012	0.151	0.159	0.159	*****	*****	29.90	0.009
1245	105.	0.138	0.119	0.010	0.147	0.147	0.147	*****	*****	30.28	0.009
1300	120.	0.166	0.142	0.006	0.144	0.145	0.145	*****	0.010	30.61	0.007
1320	150.	0.219	0.178	0.006	0.125	0.131	0.131	*****	*****	0.126	0.149
1430	180.	0.263	0.223	0.005	0.115	0.116	0.116	*****	0.017	31.18	0.010
1434	214.	0.320	0.266	0.004	0.105	0.105	0.105	*****	*****	31.67	0.011
1500	240.	0.352	0.311	0.004	0.096	0.096	0.097	*****	*****	32.18	0.012
1530	270.	0.396	0.353	0.004	0.085	0.085	0.085	*****	0.019	32.41	0.013
1600	300.	0.430	0.389	0.004	0.078	0.078	0.078	*****	*****	32.52	0.014
1632	332.	0.467	0.434	0.004	0.071	0.071	0.071	*****	*****	32.69	0.014
1651	351.	*****	*****	*****	*****	*****	*****	*****	*****	32.86	0.024
1700	360.	0.487	0.456	0.002	0.064	0.064	0.064	4.7	0.027	32.24	0.100
										32.94	0.018

***** NC DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

ZONE	360.0 MIN TOTAL DOSAGE	=	90.12 PPW-MIN
NC	360.0 MIN TOTAL DOSAGE	=	7.86 PPW-MIN
NO2-PAN	360.0 MIN TOTAL DOSAGE	=	38.45 PPW-MIN
PAN	360.0 MIN TOTAL DOSAGE	=	5.08 PPW-MIN
OZONE	DOSAGE GT 0.10 =		55.67 PPW-MIN
OZONE	DOSAGE GT 0.06 =		65.45 PPW-MIN
NC2-PAN	DOSAGE GT 0.25 =		0.0 PPW-MIN

SURROGATE RUN 15-C
GLASS CHAMBER
1973 JULY 16

LIGHTS ON 1130, OFF 1730 INTENSITY = 0.70 CF MAXIMUM
INITIAL RH = 75 % (22.72 DEG C) FINAL RH (NCT RECORDED)
CASC I FACTOR 1.02, MAST FACTOR 1.86
AT T = 0: SURROGATE HC = 2004 PPBC; TOTAL KCN-METHANE HC = 2127 PPBC;
METHANE = 2610 ppb

CLOCK	ELAPSED TIME(MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	C3*NO /NC2 (PPM)	TCT N (PPM)
1130	0	0.0	0.0	0.0	0.109	0.011	0.114	5.0	0.0	22.86	0.0
1145	15.	0.001	0.0	0.071	0.042	0.112	0.086	*****	24.25	0.002	0.115
1200	36.	0.032	0.020	0.028	0.081	0.104	0.081	*****	25.85	0.011	0.113
1215	45.	0.031	0.074	0.014	0.087	0.096	0.089	*****	27.23	0.013	0.108
1230	60.	0.127	0.112	0.012	0.063	0.089	0.009	0.009	28.33	0.015	0.103
1245	75.	0.159	0.143	0.011	0.076	0.083	0.083	*****	29.10	0.023	0.097
1300	90.	0.185	0.167	0.011	0.072	0.078	0.078	*****	29.73	0.028	0.095
1315	105.	0.211	0.186	0.011	0.070	0.073	0.073	*****	30.25	0.033	0.094
1320	120.	0.233	0.208	0.011	0.064	0.070	0.015	*****	30.62	0.039	0.093
1400	150.	0.278	0.259	0.012	0.061	0.067	0.012	*****	31.27	0.055	0.089
1415	165.	0.312	0.296	0.011	0.054	0.060	0.017	*****	31.62	0.063	0.082
1430	180.	0.343	0.316	0.012	0.052	0.058	0.017	*****	31.90	0.079	0.083
1500	216.	0.368	0.335	0.012	0.048	0.054	0.020	*****	32.02	0.092	0.080
1530	240.	0.395	0.348	0.012	0.044	0.051	0.022	*****	32.23	0.109	0.077
1600	270.	0.402	0.340	0.012	0.043	0.050	0.022	*****	32.11	0.113	0.077
1630	300.	0.413	0.357	0.013	0.043	0.050	0.022	*****	32.16	0.127	0.078
1700	330.	0.421	0.357	0.013	0.049	0.049	0.024	0.024	32.18	0.136	0.076
1730	360.										

***** NC DATA TAKEN DATA DISCARDED ? QUÉSTIONNABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 98.82 PPM-MIN
NC 360.0 MIN TOTAL DOSAGE = 6.14 PPM-MIN
NO2-PAN 360.0 MIN TOTAL DOSAGE = 20.13 PPM-MIN
PAN 360.0 MIN TOTAL DOSAGE = 5.62 PPM-MIN
OZONE DOSAGE GT 0.10 = C6.33 PPM-MIN
OZONE DOSAGE GT 0.08 = 72.49 PPM-MIN
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 16-C
GLASS CHAMBER
1973 JULY 17

LIGHTS ON 1025, OFF 1630 INTENSITY = 0.70 OF MAXIMUM
 INITIAL RH = 72% (APPROXIMATE) FINAL RH (NOT RECORDED)
 DASIBI FACTOR 1.02, MAST FACTOR 1.86
 AT T = 0: SURROGATE HC = 2270 PPB; TOTAL NON-METHANE HC = 2587 PPB;
 METHANE = 2660 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	N ₂ (PPM)	NO2-PAN (PPM)	NO _x -PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	03+N ₂ / NO ₂	TOT N (PPM)
1025	0.	0.0	0.0	0.006	0.002	0.008	5.1	0.0	0.048	23.17	0.0	0.008
1045	20.	0.0	0.0	0.007	0.005	0.011	*****	*****	*****	25.16	0.0	0.012
1100	35.	0.003	0.0	0.007	0.005	0.012	*****	*****	*****	26.75	0.005	0.012
1115	50.	0.007	0.0	0.008	0.006	0.013	*****	*****	*****	28.08	0.010	0.014
1130	65.	0.012	0.0	0.008	0.006	0.014	*****	0.0	*****	28.90	0.017	0.014
1145	80.	0.019	0.0	0.010	0.007	0.014	*****	*****	*****	29.60	0.028	0.017
1200	95.	0.023	0.0	0.010	0.007	0.016	*****	*****	*****	30.11	0.039	0.018
1215	110.	0.028	0.0	0.010	0.007	0.015	*****	*****	*****	30.56	0.038	0.018
1230	125.	0.036	0.019	0.010	0.008	0.016	*****	0.002	0.083	30.90	0.045	0.019
1300	155.	0.048	0.033	0.010	0.008	0.018	*****	*****	*****	31.48	0.055	0.020
1330	185.	0.062	0.050	0.011	0.009	0.019	*****	0.003	*****	31.83	0.075	0.023
1400	215.	0.073	0.056	0.012	0.008	0.019	*****	*****	*****	31.94	0.104	0.024
1430	245.	0.086	0.073	0.012	0.010	0.021	*****	0.004	0.167	32.12	0.099	0.026
1500	275.	0.102	0.076	0.014	0.016	0.025	*****	*****	*****	32.32	0.092	0.035
1530	305.	0.116	0.089	0.013	0.011	0.023	*****	0.005	*****	32.44	0.145	0.029
1600	335.	0.129	0.102	0.012	0.014	0.024	*****	*****	*****	32.50	0.113	0.031
1625	360.	0.137	0.112	0.013	0.012	0.023	4.7	0.006	*****	32.60	0.150	0.031
1630	365.	0.142	0.119	0.013	0.013	0.025	*****	*****	0.230	32.60	0.142	0.032

***** NO DATA TAKEN ? DATA DISCARDED ? QUESTIONABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 22.07 PPM-MIN

NO 360.0 MIN TOTAL DOSAGE = 3.85 PPM-MIN

NO2-PAN 360.0 MIN TOTAL DOSAGE = 3.25 PPM-MIN

PAN 360.0 MIN TOTAL DOSAGE = 0.99 PPM-MIN

OZONE DOSAGE GT 0.10 = 1.99 PPM-MIN

OZONE DOSAGE GT 0.08 = 4.26 PPM-MIN

NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 17-C
GLASS CHAMBER

1973 JULY 18

LIGHTS ON 1030, OFF (NOT RECORDED) INTENSITY = 0.70 OF MAXIMUM
 INITIAL RH = 70 % (23.5 DEG C) FINAL RH (NOT RECORDED)
 DASIBI FACTOR 1.02, TAST FACTOR 1.86
 AT T = 0: SURROGATE HC = 1840 PPBC; TOTAL NON-METHANE HC = 1959 PPBC;
 METHANE = 2690 ppb

CLOCK TIME (MIN)	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	03*NO /NO2 (PPM)	TOT N (PPM)
1030	0.	0.0	0.0	0.018	0.098	5.1	0.0	0.080	23.17	0.0	0.102	
1045	15.	0.005	0.0	0.049	0.048	0.094	*****	*****	24.60	0.005	0.100	
1100	30.	0.043	0.037	0.019	0.073	0.089	*****	*****	26.20	0.011	0.096	
1115	45.	0.090	0.074	0.012	0.072	0.082	*****	*****	27.51	0.015	0.090	
1130	60.	0.133	0.112	0.011	0.057	0.074	*****	*****	28.51	0.021	0.085	
1145	75.	0.163	0.147	0.010	0.063	0.069	*****	*****	29.30	0.025	0.082	
1200	90.	0.191	0.167	0.010	0.060	0.066	*****	*****	29.86	0.030	0.080	
1215	105.	0.215	0.136	0.010	0.055	0.061	*****	*****	30.21	0.037	0.077	
1230	120.	0.236	0.205	0.011	0.053	0.059	*****	*****	30.68	0.048	0.077	
1300	150.	0.275	0.240	0.010	0.049	0.056	*****	*****	31.30	0.054	0.073	
1330	180.	0.306	0.281	0.011	0.046	0.052	*****	*****	31.80	0.072	0.073	
1405	215.	0.338	0.318	0.011	0.042	0.049	*****	*****	32.19	0.087	0.071	
1432	242.	0.353	0.339	0.011	0.038	0.047	*****	*****	32.28	0.099	0.068	
1502	272.	0.379	0.307	0.012	0.037	0.045	*****	*****	32.40	0.120	0.068	
1530	300.	0.379	0.303	0.012	0.036	0.044	*****	*****	32.55	0.128	0.067	
1600	330.	0.395	0.325	0.012	0.034	0.043	*****	*****	32.60	0.138	0.066	
1630	360.	0.402	0.348	0.012	0.034	0.043	4.8	0.020	0.265	0.140	0.066	

***** NC DATA TAKEN DATA DISCARDED ? QUESTIONABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 96.21 ppm-min
 NO 360.0 MIN TOTAL DOSAGE = 5.19 ppm-min
 NO2-PAN 360.0 MIN TOTAL DOSAGE = 16.91 ppm-min
 PAN DOSAGE GT 0.10 = 63.33 ppm-min
 OZONE DOSAGE GT 0.08 = 69.63 ppm-min
 NO2-PAN DOSAGE GT 0.25 = 0.0 ppm-min

SURROGATE RUN 18-C
GLASS CHAMBER
1973 JULY 19

LIGHTS ON 1000, OFF 1704 - INTENSITY = 0.70 OF MAXIMUM
INITIAL RH 72% (APPROXIMATE) FINAL RH (NOT RECORDED)
DASIBI FACTOR 1.01, MAST FACTOR 1.86
AT T = 0: SURROGATE HC = 1926 PPBC; TOTAL NON-METHANE HC = 2026 PPBC;
METHANE = 2750 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO ₂ -PAN (PPM)	NO _x -PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	03*NO ₂ /NO ₂	TOT N (PPM)
1030	0.	0.0	0.0	0.007	0.050	0.007	0.056	5.1	0.0	0.078	22.50	0.0
1040	10.	0.004	*****	*****	*****	*****	*****	*****	*****	*****	*****	0.058
1045	15.	0.010	0.0	0.025	0.030	0.053	0.047	*****	*****	*****	23.85	0.038
1050	30.	0.055	0.052	0.010	0.039	0.047	*****	*****	*****	*****	25.45	0.013
1055	45.	0.106	0.091	0.008	0.036	0.043	*****	*****	*****	*****	26.74	0.025
1100	60.	0.133	0.121	0.008	0.032	0.039	0.008	*****	*****	*****	27.78	0.035
1115	75.	0.157	0.141	0.011	0.028	0.035	*****	*****	*****	*****	28.53	0.061
1130	90.	0.173	0.164	0.010	0.028	0.035	*****	*****	*****	*****	29.10	0.059
1145	105.	0.169	0.173	0.010	0.027	0.034	*****	*****	*****	*****	29.57	0.067
1200	120.	0.201	0.186	0.011	0.025	0.032	0.012	*****	*****	*****	29.95	0.087
1232	152.	0.214	0.201	0.010	0.025	0.032	*****	*****	*****	*****	30.30	0.082
1300	180.	0.239	0.221	0.011	0.024	0.033	0.014	*****	*****	*****	30.97	0.107
1330	210.	0.256	0.236	0.011	0.024	0.033	*****	*****	*****	*****	31.41	0.114
1400	240.	0.268	0.257	0.011	0.024	0.034	0.014	0.152	*****	*****	31.90	0.119
1430	270.	0.281	0.260	0.012	0.026	0.035	*****	*****	*****	*****	32.15	0.130
1500	300.	0.291	0.275	0.013	0.026	0.036	0.013	*****	*****	*****	32.27	0.146
1530	330.	0.303	0.286	0.012	0.027	0.036	0.014	*****	*****	*****	32.50	0.132
1600	360.	0.311	0.298	0.013	0.027	0.037	4.9	0.013	0.236	*****	32.44	0.149
1634	394.	0.318	0.307	0.014	0.026	0.037	0.014	*****	*****	*****	32.58	0.054
1703	423.	0.323	0.325	0.013	0.026	0.037	0.013	*****	*****	*****	32.63	0.162

***** NO DATA TAKEN

DATA DISCARDED

? QUESTIGNABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 77.00 PPM-MIN
NO 360.0 MIN TOTAL DOSAGE = 4.42 PPM-MIN
NO₂-PAN 360.0 MIN TOTAL DOSAGE = 9.65 PPM-MIN
PAN 360.0 MIN TOTAL DOSAGE = 4.15 PPM-MIN
OZONE DOSAGE GT 0.10 = 43.80 PPM-MIN
OZONE DOSAGE GT 0.08 = 50.25 PPM-MIN
NO₂-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

PLOT

SURROGATE RUN 19-E
GLASS CHAMBER
1973 OCT 2

LIGHTS ON 1130, OFF 1730 INTENSITY = 0.70 OF MAXIMUM
 INITIAL RH = 85 % (22.97 DEG C) FINAL RH = 40 % (APPROXIMATE)
 DASIBI FACTOR 1.01, MAST FACTOR 1.6
 AT T = 0: SURROGATE HC = 1805 PPBC; TOTAL NON-METHANE HC = 2176 PPBC;
 METHANE = 1920 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	03*NO2 /NO2	TOT N (PPM)	
1130	0.	0.0	0.0	0.004	0.046	5.2*	3.0	0.052	23.00	0.0	0.046	0.0	
1145	15.	0.019	0.005	0.022	0.023	0.045	*****	*****	24.21	0.018	0.046	0.052	
1200	30.	0.059	0.037	0.020	0.023	0.042	*****	*****	25.78	0.068	0.046	0.046	
1215	45.	0.074	0.064	0.020	0.022	0.043	*****	*****	26.97	0.090	0.047	0.047	
1230	60.	0.088	0.088	0.022	0.021	0.040	*****	0.078	28.11	0.131	0.047	0.047	
1245	75.	0.097	0.088	0.022	0.021	0.041	*****	*****	28.78	0.112	0.047	0.047	
1300	90.	0.106	0.096	0.022	0.020	0.041	*****	*****	29.33	0.129	0.053	0.053	
1315	105.	0.115	0.101	0.025	0.022	0.043	*****	*****	29.68	0.137	0.053	0.053	
1330	120.	0.120	0.112	0.025	0.022	0.042	*****	*****	29.83	0.149	0.053	0.053	
1345	135.	0.128	0.117	0.025	0.022	0.042	*****	*****	29.94	0.153	0.049	0.049	
1400	150.	0.135	0.123	0.023	0.020	0.042	*****	*****	30.03	0.181	0.049	0.049	
1415	165.	0.140	0.128	0.024	0.019	0.041	*****	*****	30.15	0.182	0.050	0.050	
1430	180.	0.147	0.144	0.024	0.019	0.042	*****	0.007	0.119	30.21	0.188	0.053	0.053
1445	195.	0.151	0.144	0.025	0.020	0.043	*****	*****	30.33	0.196	0.053	0.053	
1500	210.	0.157	0.144	0.025	0.020	0.043	*****	*****	30.41	0.205	0.052	0.052	
1530	240.	0.168	0.160	0.024	0.020	0.044	*****	0.008	0.146	30.58	0.217	0.054	0.054
1600	270.	0.177	0.165	0.025	0.021	0.043	*****	*****	30.71	0.229	0.054	0.054	
1630	300.	0.185	0.184	0.025	0.020	0.044	*****	0.008	0.181	30.80	0.239	0.056	0.056
1700	330.	0.195	0.184	0.026	0.021	0.044	*****	*****	30.86	0.263	0.055	0.055	
1730	360.	0.202	0.197	0.026	0.020	0.045	5.0	*****	30.87				

***** NO DATA TAKEN

? QUESTIONABLE DATA

PLOT

DATA DISCARDED

OZONE 360.0 MIN TOTAL DOSAGE = 48.99 PPM-MIN
 NO2-PAN 360.0 MIN TOTAL DOSAGE = 6.73 PPM-MIN
 PAN 360.0 MIN TOTAL DOSAGE = 7.38 PPM-MIN
 OZONE DOSAGE GT 0.10 = 16.19 PPM-MIN
 OZONE DOSAGE GT 0.08 = 22.11 PPM-MIN
 NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 20-E
GLASS CHAMBER
1973 OCT 3

LIGHTS ON 1130, OFF 1730 INTENSITY = 70% OF MAXIMUM
INITIAL RH = 73 % (23.21 DEG C) FINAL RH = 55 % (30.8 DEG C)
DASIBI FACTOR 1.01, MAST FACTOR 1.6
AT T = 0: SURROGATE HC = 468 PPBC; TOTAL NON-METHANE HC = 564 PPBC;
METHANE = 1730 PPB

CLOCK TIME	ELAPSED TIME(MIN)	OZONE (PPM)	OXIDANT (PPM)	N2 (PPM)	NO2-PAN (PPM)	NOx-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	O3*NO2 /NO2	TOT N (PPM)
1130	0.	0.0	0.0	0.122	0.002	0.124	4.4	0.0	0.034	23.20	0.0	0.125
1145	15.	0.002	0.0	0.108	0.020	0.125	*****	*****	*****	24.55	0.011	0.128
1200	30.	0.004	0.002	0.085	0.041	0.122	*****	*****	*****	25.98	0.008	0.126
1215	45.	0.011	0.0	0.070	0.060	0.120	*****	*****	*****	27.19	0.013	0.130
1230	60.	0.020	0.003	0.054	0.073	0.120	*****	0.0	0.048	28.13	0.015	0.127
1245	75.	0.031	0.018	0.043	0.084	0.120	*****	*****	*****	28.80	0.016	0.127
1300	90.	0.041	0.032	0.036	0.086	0.113	*****	*****	*****	29.49	0.017	0.122
1315	105.	0.052	0.040	0.035	0.089	0.113	*****	*****	*****	29.80	0.020	0.125
1330	120.	0.066	0.054	0.032	0.090	0.110	*****	*****	*****	30.20	0.024	0.124
1400	135.	0.079	0.054	0.028	0.087	0.105	*****	*****	*****	30.77	0.030	0.116
1430	150.	0.094	0.054	0.025	0.081	0.099	*****	*****	0.003	31.07	0.037	0.109
1500	210.	0.120	0.144	0.025	0.081	0.095	*****	*****	0.104	31.20	0.048	0.109
1530	240.	0.153	0.142	0.025	0.081	0.095	*****	*****	0.140	31.40	0.065	0.106
1600	270.	0.186	0.176	0.026	0.076	0.092	*****	*****	0.140	31.53	0.079	0.098
1630	300.	0.217	0.208	0.025	0.086	0.086	*****	*****	0.005	31.53	0.104	0.094
1700	330.	0.245	0.240	0.026	0.062	0.079	*****	*****	0.005	31.61	0.124	0.091
1730	360.	0.277	0.270	0.026	0.059	0.078	*****	*****	0.006	31.61	0.145	0.083
		0.301	0.294	0.026	0.055	0.074	4.4	0.006	0.235	31.65		

***** NO DATA TAKEN

---- DATA DISCARDED

---- QUESTIONABLE DATA

ZONE	360.0	MIN TOTAL DOSAGE =	47.17 PPM-MIN
N2	360.0	MIN TOTAL DOSAGE =	13.98 PPM-MIN
NO2-PAN	360.0	MIN TOTAL DOSAGE =	25.07 PPM-MIN
PAN	360.0	MIN TOTAL DOSAGE =	0.97 PPM-MIN
ZONE DOSAGE GT 0.10 =			20.95 PPM-MIN
OZONE DOSAGE GT 0.08 =			25.27 PPM-MIN
NO2-PAN DOSAGE GT 0.25 =			0.0 PPM-MIN

SURROGATE RUN 21-E
GLASS CHAMBER
1973 OCT 4

LIGHTS ON 1100, OFF 1700 INTENSITY = 70% OF MAXIMUM
 INITIAL RH = 64 % (23.25 DEG C) FINAL RH = 44 % (APPROXIMATE)
 DASIFI FACTOR 1.01; MAST FACTOR 1.6
 AT T = 0: SURROGATE HC = 490 PPBC; TOTAL NON-METHANE HC = 672 PPBC;
 METHANE = 1885 PPB

CLOCK TIME	ELAPSED TIME (MIN)	ZZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOx-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	TOT N (PPM)	03*NO / NO2 (PPM)
1100	0.	0.0	0.0	0.185	0.008	0.192	5.0	0.0	0.065	23.35	0.0	0.193
1130	30.	0.002	0.0	0.163	0.029	0.188	*****	*****	*****	26.24	0.011	0.192
1145	45.	0.003	0.0	0.148	0.043	0.186	*****	*****	*****	27.55	0.010	0.191
1200	60.	0.010	0.0	0.134	0.054	0.184	*****	*****	0.051	28.67	0.025	0.186
1218	78.	0.013	0.005	0.120	0.066	0.180	*****	*****	*****	29.50	0.024	0.186
1230	90.	0.019	0.010	0.114	0.074	0.179	*****	*****	*****	29.98	0.029	0.186
1245	105.	0.023	0.018	0.104	0.079	0.176	*****	*****	*****	30.53	0.031	0.184
1300	120.	0.026	0.019	0.100	0.084	0.176	*****	*****	0.0	30.92	0.031	0.184
1330	150.	0.043	0.042	0.092	0.092	0.173	*****	*****	*****	31.49	0.044	0.185
1400	180.	0.065	0.062	0.088	0.093	0.171	*****	*****	0.093	32.00	0.061	0.181
1430	210.	0.086	0.078	0.084	0.092	0.174	*****	*****	*****	32.52	0.078	0.178
1500	240.	0.110	0.112	0.084	0.090	0.166	*****	*****	0.002	0.124	0.102	0.176
1530	270.	0.142	0.133	0.084	0.084	0.159	*****	*****	*****	32.80	0.143	0.170
1600	300.	0.171	0.163	0.084	0.081	0.157	*****	*****	0.003	0.165	0.177	0.168
1636	336.	0.206	0.203	0.084	0.077	0.154	*****	*****	0.004	33.44	0.225	0.164
1700	360.	0.239	0.237	0.084	0.070	0.148	5.0	0.0	0.203	33.50	0.286	0.158

***** NO DATA TAKEN

---- DATA DISCARDED ? QUESTIONABLE DATA

OZONE	360.0	MIN TOTAL DOSAGE	29.73	PPM-MIN
NO	360.0	MIN TOTAL DOSAGE	37.28	PPM-MIN
NO2-PAN	360.0	MIN TOTAL DOSAGE	26.73	PPM-MIN
PAN	360.0	MIN TOTAL DOSAGE	0.46	PPM-MIN
OZONE DOSAGE GT	0.10		8.76	PPM-MIN
OZONE DOSAGE GT	0.08		11.64	PPM-MIN
NO2-PAN DOSAGE GT	0.25		0.0	PPM-MIN

SURROGATE RUN 22-E
GLASS CHAMBER
1973 OCT 5

LIGHTS ON 0930, OFF 1600 INTENSITY = 70% OF MAXIMUM
INITIAL RH = 56 % (22.86 DEG C) FINAL RH = 32 % (APPROXIMATE)
DASIBI FACTOR 1.01, MAST FACTOR 1.6
AT T = 0: SURROGATE HC = 501 PPBC; TOTAL NON-METHANE HC = 604 PPBC;
METHANE = 1600 PPB

CLOCK TIME [MIN]	ELAPSED TIME [MIN]	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	03*NO /NO2 (PPM)	TGT N (PPM)
930	0.	0.0	0.0	0.001	0.030	5.7	0.0	0.063	22.85	0.0	0.029
945	15.	0.003	0.0	0.002	0.035	*****	*****	*****	24.20	0.41	0.035
1000	30.	0.011	0.0	0.031	0.005	0.035	*****	*****	25.75	0.072	0.036
1015	45.	0.016	0.002	0.034	0.005	0.036	*****	*****	26.95	0.113	0.038
1030	60.	0.026	0.008	0.032	0.010	0.037	*****	0.0	0.054	0.089	0.042
1045	75.	0.031	0.014	0.034	0.007	0.037	*****	*****	27.73	0.146	0.041
1100	90.	0.040	0.021	0.035	0.011	0.038	*****	*****	28.37	0.130	0.046
1115	105.	0.047	0.032	0.035	0.011	0.040	*****	*****	28.90	0.153	0.046
1130	120.	0.057	0.046	0.036	0.010	0.042	*****	0.0	0.079	29.50	0.212
1200	150.	0.072	0.059	0.037	0.011	0.045	*****	*****	29.93	0.232	0.049
1230	180.	0.086	0.062	0.037	0.011	0.046	*****	0.001	0.107	30.20	0.290
1300	210.	0.100	0.075	0.040	0.013	0.048	*****	*****	30.47	0.307	0.054
1330	240.	0.116	0.094	0.042	0.014	0.050	*****	0.002	0.128	30.72	0.359
1400	270.	0.128	0.096	0.042	0.011	0.051	*****	*****	30.80	0.503	0.055
1430	300.	0.143	0.128	0.046	0.010	0.112	0.003	0.129	31.05	0.641	0.059
1500	330.	0.155	0.120	0.044	0.014	0.055	*****	*****	31.09	0.497	0.061
1530	360.	0.167	0.139	0.047	0.011	0.056	5.2	0.003	0.186	31.19	0.684

***** NO DATA TAKEN ----- DATA DISCARDED ----- ? QUESTIONABLE DATA

OZONE	360.0	MIN TOTAL DOSAGE	=	30.41	PPM-MIN
NO	360.0	MIN TOTAL DOSAGE	=	13.85	PPM-MIN
NO2-PAN	360.0	MIN TOTAL DOSAGE	=	3.66	PPM-MIN
PAN	360.0	MIN TOTAL DOSAGE	=	0.45	PPM-MIN
OZONE DOSAGE GT	0.10	=	5.27	PPM-MIN	
OZONE DOSAGE GT	0.08	=	8.75	PPM-MIN	
NO2-PAN DOSAGE GT	0.25	=	0.0	PPM-MIN	

SURROGATE RUN 23-E
GLASS CHAMBER
1973 OCT. 10

LIGHTS ON 1030, OFF 1645 INTENSITY = 70% OF MAXIMUM
INITIAL RH = 50 % (30.10 DEG C) FINAL RH NOT DETERMINED
JASIFI FACTOR 1.01, MAST FACTOR 1.6
AT T = 0: SURROGATE HC = 1915 PPBC; TOTAL NON-METHANE HC = 2276 PPBC;
METHANE = 1438 PPB

CLOCK TIME (MIN)	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO /NO2	TOT N (PPM)
1030	0.	0.0	0.0	0.296	0.050	0.340	4.6	0.0	0.112	30.66	29.83	0.0
1045	15.	0.002	0.3	0.266	0.072	0.330	*****	*****	*****	30.27	29.95	0.007
1100	30.	0.005	0.0	0.221	0.108	0.329	*****	*****	*****	30.00	30.20	0.010
1115	45.	0.009	0.0	0.193	0.143	0.324	*****	*****	*****	30.11	30.17	0.012
1130	60.	0.012	0.0	0.158	0.176	0.324	*****	0.0	0.147	30.08	30.16	0.011
1145	75.	0.022	0.0	0.126	0.202	0.313	*****	*****	*****	30.16	30.03	0.014
1200	90.	0.028	0.021	0.108	0.213	0.306	*****	*****	*****	30.16	30.03	0.014
1215	105.	0.039	0.034	0.092	0.224	0.298	*****	*****	*****	30.19	30.06	0.016
1230	120.	0.053	0.050	0.080	0.231	0.291	*****	*****	0.004	0.184	30.22	31.00
1300	150.	0.090	0.098	0.065	0.235	0.279	*****	*****	*****	30.35	30.23	0.025
1330	180.	0.120	0.096	0.058	0.232	0.268	*****	*****	0.006	0.066	30.45	30.33
1400	210.	0.155	0.192	0.054	0.220	0.256	*****	*****	*****	30.60	30.48	0.038
1430	240.	0.188	0.162	0.052	0.207	0.243	*****	*****	0.009	0.238	30.77	30.65
1502	272.	0.221	0.202	0.055	0.202	0.243	*****	*****	*****	30.90	31.04	0.221
1530	300.	0.259	0.218	0.055	0.202	0.243	*****	*****	0.011	0.243	31.15	31.00
1604	334.	0.299	0.253	0.055	0.202	0.243	*****	*****	*****	31.27	31.08	0.299
1630	360.	0.334	0.282	0.055	0.202	0.243	*****	*****	4.2	0.015	0.249	31.25

***** NO DATA TAKEN ----- DATA DISCARDED

? QUESTIONABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 47.68 PPM-MIN
NO 240.0 MIN TOTAL DOSAGE = 27.58 PPM-MIN
NO2-PAN 240.0 MIN TOTAL DOSAGE = 46.38 PPM-MIN
PAN 360.0 MIN TOTAL DOSAGE = 2.29 PPM-MIN
OZONE DOSAGE GT 0.10 = 22.53 PPM-MIN
OZONE DOSAGE GT 0.08 = 26.73 PPM-MIN
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 24-E
GLASS CHAMBER
1973 OCT-17

LIGHTS ON 1045, OFF 1645 INTENSITY = 0.70 OF MAXIMUM
 INITIAL RH = 50 % (31.20 DEG C) FINAL RH = 45 % (30.90 DEG C)
 DASB1 FACTOR 1.01, MAST FACTOR 1.6.
 AT T = 0: SURROGATE HC = 538 PPBC; TOTAL NON-METHANE HC = 734 PPB;
 METHANE = 2240 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NJ (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO2 /NO2	TOT N (PPM)
1045	0.	0.0	0.0	0.048	0.331	3.7	0.0	0.093	*****	31.21	31.27	0.0	0.334
1047	2.	0.003	0.0	0.278	0.048	0.324	*****	*****	*****	33.22	31.27	0.018	0.326
1100	15.	0.004	0.0	0.265	0.066	0.325	*****	*****	*****	31.13	30.45	0.016	0.331
1115	30.	0.004	0.0	0.240	0.086	0.322	*****	*****	*****	30.67	30.41	0.011	0.326
1130	45.	0.006	0.0	0.210	0.110	0.316	*****	*****	*****	30.74	30.58	0.012	0.320
1145	60.	0.007	0.0	0.184	0.131	0.310	*****	0.0	0.124	30.95	30.83	0.010	0.314
1200	75.	0.011	0.006	0.166	0.145	0.302	*****	*****	*****	31.16	31.04	0.013	0.311
1215	90.	0.010	0.006	0.144	0.157	0.298	*****	*****	*****	31.26	31.24	0.009	0.301
1230	105.	0.015	0.008	0.130	0.169	0.290	*****	*****	*****	31.50	31.44	0.012	0.299
1245	120.	0.015	0.008	0.114	0.179	0.286	*****	0.0	0.159	31.63	31.61	0.010	0.293
1315	150.	0.024	0.019	0.086	0.193	0.275	*****	*****	*****	31.93	31.97	0.011	0.280
1345	180.	0.032	0.026	0.072	0.202	0.264	*****	0.0	0.154	32.26	32.29	0.012	0.274
1415	210.	0.044	0.037	0.059	0.203	0.254	*****	*****	*****	32.57	32.58	0.013	0.263
1445	240.	0.056	0.043	0.048	0.204	0.245	*****	0.001	0.172	32.92	32.97	0.013	0.253
1515	270.	0.069	0.056	0.060	0.202	0.232	*****	*****	*****	33.10	32.90	0.016	0.244
1545	300.	0.090	0.069	0.035	0.200	0.224	*****	0.002	0.192	33.14	32.95	0.015	0.236
1615	330.	0.107	0.090	0.028	0.192	0.214	*****	*****	*****	33.25	33.06	0.015	0.222
1645	360.	0.125	0.099	0.025	0.189	0.204	3.2	0.002	0.224	33.29	33.10	0.017	0.217

***** NO DATA TAKEN DATA DISCARDED ? QUESTIONABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 15.77 PPM-MIN
 NJ 360.0 MIN TOTAL DOSAGE = 36.14 PPM-MIN
 NO2-PAN 360.0 MIN TOTAL DOSAGE = 62.09 PPM-MIN
 PAN 360.0 MIN TOTAL DOSAGE = 0.25 PPM-MIN
 OZONE DOSAGE GT 0.10 = 0.59 PPM-MIN
 OZONE DOSAGE GT 0.08 = 1.79 PPM-MIN
 NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

PLOT

SURROGATE RUN 25-E
GLASS CHAMBER
1973 OCT '19

LIGHTS ON 1100, OFF 1700 INTENSITY = 0.70 OF MAXIMUM
 INITIAL RH = 50 % (32.00 DEG C) FINAL RH = 34 % (32.95 DEG C)
 DASIBI FACTOR 1.01, MAST FACTOR 1.6
 AT T = 0: SURROGATE HC = 514 PPBC; TOTAL NON-VETHANE HC = 808 PPBC;
 METHANE = 1730 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOx-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NJ /NO2	TOT N (PPM)	
1100	0.	0.002	0.0	0.010	0.001	0.0	0.0	0.0	0.147	34.13	32.00	0.016	0.011	
1115	15.	0.	0.002	0.011	0.002	0.013	*****	*****	32.52	31.65	0.027	0.013		
1130	30.	0.009	0.0	0.011	0.004	0.014	*****	*****	31.45	31.27	0.027	0.014		
1145	45.	0.016	0.0	0.012	0.004	0.016	*****	*****	31.18	31.07	0.054	0.016		
1200	60.	0.023	0.005	0.012	0.005	0.015	0.0	0.199	31.10	31.10	0.058	0.017		
1215	75.	0.031	0.010	0.012	0.009	0.020	*****	*****	31.17	31.23	0.040	0.022		
1230	90.	0.037	0.018	0.012	0.009	0.020	*****	*****	31.28	31.40	0.049	0.022		
1245	105.	0.043	0.030	0.013	0.008	0.020	*****	*****	31.41	31.52	0.075	0.022		
1300	120.	0.052	0.035	0.012	0.010	0.021	*****	*****	31.54	31.58	0.063	0.023		
1330	150.	0.066	0.046	0.012	0.010	0.021	*****	*****	31.82	31.81	0.075	0.024		
1400	180.	0.077	0.055	0.012	0.010	0.022	*****	*****	31.65	32.04	0.092	0.024		
1430	210.	0.090	0.066	0.013	0.011	0.022	*****	*****	32.04	31.97	0.108	0.026		
1500	240.	0.102	0.077	0.013	0.011	0.024	*****	*****	31.96	31.68	0.126	0.026		
1530	270.	0.119	0.093	0.013	0.012	0.024	*****	*****	31.99	31.95	0.135	0.028		
1600	300.	0.126	0.096	0.013	0.013	0.025	*****	0.003	0.174	32.02	32.03	0.132	0.029	
1630	330.	0.135	0.104	0.014	0.014	0.027	*****	*****	31.98	32.04	0.144	0.031		
1700	360.	0.145	0.110	0.016	0.013	0.026	0.9	0.003	0.213	31.96	32.00	0.171	0.032	

***** NJ DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 27.31 PPM-MIN
 NO 360.0 MIN TOTAL DOSAGE = 4.55 PPM-MIN
 NO2-PAN 360.0 MIN TOTAL DOSAGE = 3.43 PPM-MIN
 PAN 360.0 MIN TOTAL DOSAGE = 0.61 PPM-MIN
 OZONE DOSAGE GT 0.10 = 3.16 PPM-MIN
 OZONE DOSAGE GT 0.08 = 6.16 PPM-MIN
 NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 26-E
GLASS CHAMBER
1973 OCT 22

LIGHTS ON 1130, OFF 1733 INTENSITY = 0.70 OF MAXIMUM
INITIAL RH = 52 % (31.11 DEG C) FINAL RH = 35 % (31.41 DEG C)
DASIBI FACTOR 1.01, MAST FACTOR 1.6
AT T = 0: SURROGATE HC = 533 PPBC; TOTAL NON-METHANE HC = 848 PPBC;
METHANE = 1700 PPB

CLOCK TIME	ELAPSED TIME (MIN)	DZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO ₂ -PAN (PPM)	NO _x -PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	TOT N /NO ₂ (PPM)
1121	-9.	0.0	0.0	0.094	0.012	0.100	*****	*****	*****	33.25	30.81	0.0
1130	0.	0.002	0.0	0.094	0.011	0.102	1.6	0.0	0.113	33.12	30.65	0.018
1145	15.	0.005	0.0	0.074	0.030	0.103	*****	*****	*****	32.22	31.22	0.013
1200	30.	0.012	0.002	0.056	0.0101	0.060	0.048	0.048	*****	31.67	31.42	0.106
1215	45.	0.026	0.008	0.040	0.010	0.097	0.056	0.056	*****	31.19	30.97	0.014
1230	60.	0.044	0.029	0.034	0.010	0.094	0.069	0.069	0.001	0.181	31.45	31.22
1245	75.	0.062	0.042	0.026	0.010	0.071	0.071	0.071	*****	31.52	31.33	0.023
1303	90.	0.081	0.059	0.025	0.010	0.092	0.071	0.071	*****	31.63	31.47	0.029
1315	105.	0.102	0.075	0.024	0.010	0.088	0.070	0.070	*****	31.47	31.33	0.035
1330	120.	0.124	0.093	0.024	0.010	0.084	0.067	0.067	0.002	0.226	31.20	0.044
1400	150.	0.163	0.131	0.023	0.010	0.079	0.060	0.060	*****	31.11	31.18	0.062
1430	180.	0.204	0.163	0.024	0.010	0.073	0.055	0.055	0.005	0.262	31.00	0.086
1500	210.	0.238	0.197	0.024	0.010	0.069	0.051	0.051	0.005	0.262	31.15	0.089
1530	240.	0.272	0.230	0.024	0.010	0.064	0.046	0.046	0.007	0.262	31.11	0.096
1600	270.	0.300	0.251	0.024	0.010	0.063	0.041	0.041	0.009	0.262	31.15	0.094
1630	300.	0.321	0.277	0.024	0.010	0.061	0.039	0.039	0.009	0.262	31.15	0.094
1700	330.	0.337	0.294	0.024	0.010	0.056	0.036	0.036	0.010	0.284	31.42	0.072
1730	360.	0.352	0.307	0.024	0.010	0.054	0.036	0.036	1.7	0.010	31.45	31.41

***** NO DATA TAKEN

DATA DISCARDED

QUESTIONABLE DATA

DZONE 360.0 MIN TOTAL DOSAGE = 63.14 PPM-MIN
NO 360.0 MIN TOTAL DOSAGE = 10.80 PPM-MIN
NO₂-PAN 360.0 MIN TOTAL DOSAGE = 13.28 PPM-MIN
PAN 360.0 MIN TOTAL DOSAGE = 1.83 PPM-MIN
OZONE DOSAGE GT 0.10 = 38.42 PPM-MIN
OZONE DOSAGE GT 0.08 = 43.68 PPM-MIN
NO₂-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 27-E
GLASS CHAMBER
1973 OCT 23

LIGHTS ON 1000, OFF (NOT RECORDED) INTENSITY = 0.70 OF MAXIMUM
INITIAL RH = 51 % (30.45 DEG C) FINAL RH = 35 % (31.00 DEG C)
DASIBI FACTOR 1.01, MAST FACTOR 1.6
AT T = 0: SURROGATE HC = 451 PPBC; TOTAL NON-METHANE HC = 609 PPBC;
METHANE = 1680 PPB

CLOCK TIME	ELAPSED TIME (MIN)	ZONE (PPM)	OXIDANT (PPM)	N ₂ (PPM)	NO ₂ -PAN (PPM)	NO _x -PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO /NO ₂	TOT N (PPM)	
1000	0.	0.0	0.0	0.096	0.013	0.106	1.6	0.0	0.036	33.71	31.25	0.0	0.109	
1015	15.	0.004	0.0	0.084	0.026	0.105	*****	*****	32.46	31.37	0.013	0.110		
1030	30.	0.006	0.0	0.064	0.045	0.105	*****	*****	32.03	31.40	0.009	0.109		
1045	45.	0.014	0.002	0.050	0.056	0.102	*****	*****	31.51	31.21	0.013	0.107		
1100	60.	0.023	*****	0.042	0.061	0.101	*****	*****	0.082	31.25	31.02	0.016	0.104	
1115	75.	0.034	*****	0.036	0.068	0.096	*****	*****	*****	31.13	30.95	0.016	0.106	
1130	90.	0.046	*****	0.032	0.069	0.094	*****	*****	*****	31.12	30.98	0.022	0.103	
1145	105.	0.055	*****	0.026	0.070	0.094	*****	*****	*****	31.12	30.97	0.020	0.095	
1200	120.	0.067	*****	0.026	0.071	0.092	*****	*****	0.092	30.82	30.84	0.025	0.100	
1230	150.	0.088	0.035	0.024	0.070	0.087	*****	*****	*****	30.73	30.86	0.030	0.096	
1300	180.	0.113	0.096	0.023	0.067	0.081	*****	*****	0.123	30.82	30.98	0.038	0.092	
1330	210.	0.144	0.139	0.022	0.062	0.079	*****	*****	*****	30.94	31.04	0.050	0.088	
1400	240.	0.168	0.158	0.022	0.057	0.073	*****	*****	0.004	0.142	31.09	31.22	0.064	0.083
1430	270.	0.201	0.181	0.022	0.055	0.070	*****	*****	*****	31.20	31.35	0.079	0.062	
1500	300.	0.222	0.203	0.022	0.053	0.067	*****	*****	0.005	0.123	31.31	31.45	0.091	0.079
1530	330.	0.245	0.232	0.022	0.048	0.065	*****	*****	*****	31.43	31.57	0.110	0.076	
1600	360.	0.269	0.248	0.022	0.043	0.061	1.4	0.007	*****	31.44	31.54	0.134	0.072	

***** NG DATA TAKEN

DATA DISCARDED

? QUESTIONABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 43.72 PPM-MIN
NO 360.0 MIN TOTAL DOSAGE = 11.30 PPM-MIN
NO₂-PAN 360.0 MIN TOTAL DOSAGE = 20.65 PPM-MIN
PAN 360.0 MIN TOTAL DOSAGE = 1.11 PPM-MIN
OZONE DOSAGE GT 0.10 = 17.34 PPM-MIN
OZONE DOSAGE GT 0.08 = 21.48 PPM-MIN
NO₂-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 28-E
GLASS CHAMBER
1973 OCT 24

LIGHTS ON 1200; OFF (NOT RECORDED) INTENSITY = 0.70 OF MAXIMUM
INITIAL RH = 51 % (30.81 DEG C) FINAL RH = 35 % (31.40 DEG C)
DASIBI FACTOR 1.01, MAST FACTOR 1.6
AT T = 0: SURROGATE HC = 493 PPBC; TOTAL NON-METHANE HC = 698 PPBC;
METHANE = 1870 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T SAMPLE T (DEG C)	03*NO /N32	TOI N (PPM)
1000	0.	0.001	0.0	0.182	0.024	0.203	1.3	0.0	33.68	31.28	0.008
1015	15.	0.002	0.0	0.160	0.044	0.202	*****	*****	32.06	31.00	0.007
1030	30.	0.005	0.0	0.133	0.068	0.202	*****	*****	31.52	31.15	0.010
1045	45.	0.008	0.0	0.115	0.085	0.196	*****	*****	30.96	31.06	0.011
1100	60.	0.010	0.0	0.102	0.096	0.192	*****	0.0	30.87	31.22	0.011
1115	75.	0.014	0.003	0.086	0.108	0.192	*****	*****	30.95	31.23	0.011
1130	90.	0.021	0.005	0.079	0.119	0.189	*****	*****	30.96	31.18	0.014
1145	105.	0.026	0.010	0.070	0.122	0.184	*****	*****	30.94	31.15	0.015
1200	120.	0.034	0.018	0.060	0.129	0.181	*****	0.000	0.143	30.92	31.15
1230	150.	0.048	0.032	0.048	0.134	0.176	*****	*****	31.00	31.21	0.017
1300	180.	0.063	0.043	0.036	0.132	0.168	*****	0.001	0.151	31.12	31.36
1330	210.	0.084	0.064	0.036	0.133	0.164	*****	*****	31.35	31.52	0.023
1400	240.	0.101	0.075	0.041	0.130	0.166	*****	0.001	0.163	31.45	31.55
1430	270.	0.122	0.096	0.034	0.128	0.152	*****	*****	31.53	31.54	0.032
1500	300.	0.145	0.112	0.032	0.120	0.144	*****	0.002	0.184	31.60	31.48
1530	330.	0.164	0.138	0.030	0.116	0.140	*****	*****	31.55	31.40	0.042
1600	350.	0.189	0.149	0.028	0.107	0.130	1.2	0.003	0.235	31.58	0.049

***** NJ DATA TAKEN ? DATA DISCARDED ? QUESTIONABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 26.73 PPM-MIN
NO 360.0 MIN TOTAL DOSAGE = 22.01 PPM-MIN
NO2-PAN 360.0 MIN TOTAL DOSAGE = 41.12 PPM-MIN
PAN 360.0 MIN TOTAL DOSAGE = 0.42 PPM-MIN
OZONE DOSAGE GT 0.10 = 5.30 PPM-MIN
OZONE DOSAGE GT 0.08 = 8.12 PPM-MIN
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 29-E
GLASS CHAMBER
1973 OCT 25

LIGHTS ON 1100, OFF 1700 INTENSITY = 0.70 OF MAXIMUM
INITIAL RH = 50 % (31.30 DEG C) FINAL RH = 41 % (31.42 DEG C)
ADDITIONAL NO₂ INJECTION AT 1050
DASIBI FACTOR 1.01, MAST FACTOR 1.6
AT T = 0: SURROGATE HC = 567 PPBC; TOTAL NON-METHANE HC = 645 PPBC;
METHANE = 1920 PPB

CLOCK TIME	ELAPSED TIME (MIN)	DZONE (PPM)	OXIDANT (PPM)	NO ₂ -PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	33*NO ₂ (PPM)	TOT NO ₂ (PPM)
1046	-14.	0.0	0.0	0.264	0.048	0.308	0.0	*****	*****	0.0	0.312
1058	-2.	0.0	0.0	*****	*****	*****	*****	*****	*****	0.0	*****
1100	0.	0.001	0.0	0.292	0.052	0.342	1.6	0.0	0.054	33.95	31.46
1115	15.	0.001	0.0	0.277	0.011	0.346	*****	*****	*****	33.95	31.59
1130	30.	0.004	0.0	0.264	0.079	0.338	*****	*****	*****	33.30	31.20
1145	45.	0.005	0.0	0.250	0.095	0.336	*****	*****	*****	31.86	31.46
1200	60.	0.004	0.0	0.232	0.106	0.335	*****	*****	*****	31.20	31.04
1215	75.	0.005	0.0	0.218	0.118	0.332	*****	*****	*****	30.95	30.95
1230	90.	0.008	0.0	0.204	0.128	0.326	*****	*****	*****	31.15	31.37
1245	105.	0.007	0.0	0.191	0.138	0.324	*****	*****	*****	31.28	31.49
1300	120.	0.008	0.003	0.180	0.145	0.318	*****	*****	*****	31.49	31.60
1315	135.	0.010	0.003	0.166	0.156	0.314	*****	*****	*****	31.56	31.76
1330	150.	0.012	0.005	0.156	0.166	0.312	*****	*****	*****	31.66	31.86
1400	180.	0.016	0.008	0.132	0.180	0.304	0.0	0.136	0.136	31.72	31.85
1430	210.	0.021	0.014	0.114	0.191	0.299	*****	*****	*****	31.71	31.61
1500	240.	0.027	0.024	0.097	0.200	0.288	*****	0.0	0.156	31.60	31.47
1530	270.	0.032	0.029	0.083	0.205	0.282	*****	*****	*****	31.57	31.43
1600	300.	0.043	0.037	0.072	0.206	0.272	0.0	0.194	0.194	31.62	31.46
1630	330.	0.058	0.046	0.059	0.206	0.261	*****	*****	*****	31.42	31.42
1700	360.	0.062	0.050	0.205	0.250	0.250	1.6	0.001	0.181	31.57	31.34

***** NO DATA TAKEN

DATA DISCARDED

? QUESTIONABLE DATA

DZONE 360.0 MIN TOTAL DOSAGE = 8.08 PPM-MIN
NO₂-PAN 360.0 MIN TOTAL DOSAGE = 52.87 PPM-MIN
PAN 360.0 MIN TOTAL DOSAGE = 58.37 PPM-MIN
OZONE DOSAGE GT 0.10 = 0.04 PPM-MIN
OZONE DOSAGE GT 0.08 = 0.0 PPM-MIN
NO₂-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

PLOT

SURROGATE RUN 30-E
GLASS CHAMBER
1973 OCT 26

LIGHTS ON 1130, OFF 1734 INTENSITY = 0.70 OF MAXIMUM
 INITIAL RH = 50 % (31.41 DEG C) FINAL RH (NOT RECORDED)
 DASIBL FACTOR 1.01, MAST FACTOR 1.6
 AT T = 0: SURROGATE HC = 588 PPB; TOTAL NON-METHANE HC = 744 PPB;
 METHANE = 1730 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO /NO2	TOT N (PPM)
1130	0.	0.0	0.0	0.301	0.062	0.342	1.8	0.0	0.097	33.74	31.63		0.0
1145	15.	0.001	0.0	0.289	0.056	0.346	*****	*****	*****	32.32	31.50		0.005
1200	32.	0.003	0.0	0.275	0.071	0.338	*****	*****	*****	31.15	31.10		0.012
1215	45.	0.004	0.0	0.254	0.085	0.337	*****	*****	*****	30.82	31.22		0.012
1230	60.	0.005	0.0	0.239	0.097	0.336	*****	0.0	0.093	31.04	31.32		0.012
1245	75.	0.006	0.0	0.227	0.112	0.334	*****	*****	*****	31.04	31.32		0.012
1300	90.	0.006	0.0	0.205	0.121	0.326	*****	*****	*****	31.22	31.37		0.012
1315	105.	0.009	0.005	0.193	0.134	0.325	*****	*****	*****	31.31	31.39		0.010
1330	120.	0.009	*****	0.181	0.145	0.323	*****	0.0	0.115	31.38	31.48		0.013
1401	151.	0.013	*****	0.156	0.165	0.314	*****	*****	*****	31.43	31.41		0.011
1430	180.	0.015	*****	0.134	0.174	0.305	*****	0.0	0.129	31.48	31.40		0.012
1500	210.	0.020	*****	0.118	0.182	0.299	*****	*****	*****	31.43	31.36		0.012
1530	240.	0.027	*****	0.098	0.196	0.290	0.0	0.138	0.138	31.50	31.46		0.013
1600	270.	0.031	*****	0.085	0.203	0.283	*****	*****	*****	31.54	31.50		0.013
1630	300.	0.040	*****	0.074	0.206	0.276	0.0	0.152	0.152	31.52	31.48		0.015
1702	332.	0.049	*****	0.062	0.208	0.265	*****	0.0	0.166	31.52	31.46		0.015
1730	360.	0.059	*****	0.058	0.205	0.260	1.6	0.0	0.166	31.48	31.48		0.016

***** NO DATA TAKEN ? DATA DISCARDED ? QUESTIONABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 7.49 PPM-MIN
 NO 360.0 MIN TOTAL DOSAGE = 54.33 PPM-MIN
 NO2-PAN 360.0 MIN TOTAL DOSAGE = 56.83 PPM-MIN
 PAN 360.0 MIN TOTAL DOSAGE = 0.0 PPM-MIN
 OZONE DOSAGE GT 0.10 = 0.0 PPM-MIN
 OZONE DOSAGE GT 0.08 = 0.0 PPM-MIN
 NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 31-F
GLASS CHAMBER
1973 OCT 29

LIGHTS ON 1015, OFF 1758 INTENSITY = 0.70 OF MAXIMUM
INITIAL RH = 50 % (31.25 DEG C) FINAL RH = 31 % (31.64 DEG C)
DASIRI FACTOR 1.01, MAST FACTOR 1.6
AT T = 0: SURROGATE HC = 445 PPBC; TOTAL NON-METHANE HC = 599 PPBC;
METHANE = 1730 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO /NO2 (PPM)	TGT N (PPM)
1015	0.	0.001	0.0	0.248	0.074	0.322	1.4	0.0	0.109	33.96	31.68	0.003	0.323
1030	15.	0.006	0.0	0.239	0.085	0.322	1.4	0.0	*****	32.56	31.65	0.017	0.324
1045	30.	0.004	0.0	0.227	0.095	0.316	1.4	0.0	*****	31.62	31.48	0.010	0.322
1100	45.	0.006	0.0	0.215	0.108	0.316	1.5	0.0	*****	31.25	31.29	0.012	0.323
1115	60.	0.007	0.0	0.203	0.115	0.312	1.5	0.0	0.108	31.20	31.21	0.012	0.318
1130	75.	0.006	0.002	0.192	0.124	0.310	1.4	0.0	*****	31.30	31.48	0.009	0.316
1145	90.	0.007	0.002	0.179	0.131	0.305	1.3	0.0	*****	31.45	31.63	0.010	0.310
1200	105.	0.010	0.003	0.159	0.140	0.304	1.2	0.0	*****	31.57	31.67	0.012	0.310
1215	120.	0.011	0.003	0.160	0.146	0.303	1.3	0.0	0.117	31.60	31.30	0.012	0.306
1245	150.	0.015	0.003	0.142	0.158	0.294	0.9	0.0	*****	31.50	31.52	0.014	0.300
1315	180.	0.015	0.010	0.121	0.169	0.288	0.9	0.0	0.113	31.43	31.50	0.011	0.290
1345	210.	0.024	0.019	0.108	0.180	0.278	1.3	0.0	*****	31.55	31.55	0.015	0.288
1415	240.	0.027	0.026	0.094	0.188	0.274	0.9	0.0	0.140	31.70	31.65	0.014	0.292
1445	270.	0.033	0.029	0.084	0.192	0.266	1.4	0.0	*****	31.80	31.71	0.015	0.276
1515	300.	0.043	0.037	0.073	0.194	0.259	1.4	0.0	0.143	31.83	*****	0.016	0.266
1545	330.	0.053	0.048	0.062	0.196	0.251	1.4	0.0	*****	31.85	31.75	0.017	0.259
1615	350.	0.061	0.062	0.058	0.198	0.245	1.4	0.0	0.162	31.91	31.80	0.018	0.257
1645	390.	0.073	0.069	0.049	0.195	0.237	1.3	0.0	*****	31.96	31.81	0.018	0.245
1716	421.	0.084	0.030	0.047	0.192	0.231	1.4	0.0	*****	31.80	31.72	0.020	0.240
1745	450.	0.100	0.094	0.042	0.190	0.226	1.4	0.0	*****	31.67	31.65	0.022	0.233
1753	458.	0.101	*****	*****	*****	*****	*****	0.0	*****	*****	*****	0.101	*****

***** NO DATA TAKEN
---- DATA DISCARDED
? QUESTIONABLE DATA

CZOME 360.0 MIN TOTAL DOSAGE = 8.20 PPM-MIN
NC 360.0 MIN TOTAL DOSAGE = 48.19 PPM-MIN
NO2-PAN 360.0 MIN TOTAL DOSAGE = 57.13 PPM-MIN
PAN 360.0 MIN TOTAL DOSAGE = 0.06 PPM-MIN
OZONE DOSAGE GT 0.10 = 0.0 PPM-MIN
OZONE DOSAGE GT 0.08 = 0.0 PPM-MIN
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 32-E
GLASS CHAMBER
1973 OCT 31

LIGHTS ON 1000, OFF 1615 INTENSITY = 0.70 OF MAXIMUM
INITIAL RH = 48 % (31.46 DEG C) FINAL RH (NOT RECORDED)

SECOND DASIBI 1003 PUT ON CHAMBER FOR 1130 READINGS

DASIBI FACTOR 1.01, MAST FACTOR 1.6
AT T = 0: SURROGATE HC = 535 PPBC; TOTAL NON-METHANE HC = 682 PPBC;
METHANE = 1780 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NJ (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	DASIBI 03 (PPM)	TOT N /NO2 (PPM)	D3*NO (PPM)	TOT N (PPM)
1000	0.	0.001	0.0	0.247	0.034	0.276	1.3	0.0	*****	33.87	31.52	*****	0.007	0.261	
1015	15.	0.002	0.0	0.238	0.044	0.276	*****	*****	*****	32.31	31.40	*****	0.011	0.232	
1025	25.	0.003	0.0	0.220	0.059	0.276	*****	*****	*****	31.01	30.50	*****	0.011	0.278	
1050	50.	0.004	0.0	0.206	0.071	0.275	*****	*****	*****	30.78	30.90	*****	0.012	0.277	
1100	60.	0.003	0.0	0.196	0.083	0.272	*****	0.0	0.073	30.92	31.24	*****	0.007	0.278	
1115	75.	0.006	0.003	0.182	0.095	0.272	*****	*****	*****	31.22	31.58	*****	0.012	0.277	
1130	90.	0.006	*****	0.170	0.106	0.269	*****	*****	*****	31.46	31.51	*****	0.006	0.276	
1145	105.	0.008	0.0	0.157	0.109	0.265	1.3	*****	*****	31.53	31.49	*****	0.012	0.266	
1200	120.	0.009	0.0	0.154	0.119	0.578	*****	0.0	0.097	31.53	31.45	*****	0.012	0.272	
1230	150.	0.013	---	0.132	0.132	0.257	*****	*****	*****	31.60	31.46	*****	0.013	0.264	
1300	180.	0.018	---	0.118	0.144	0.253	*****	0.0	0.101	31.63	31.48	*****	0.015	0.262	
1330	210.	0.022	---	0.104	0.151	0.250	1.2	*****	*****	31.68	31.55	*****	0.015	0.259	
1400	240.	0.027	---	0.092	0.157	0.245	*****	0.0	0.113	31.74	31.60	*****	0.016	0.250	
1430	270.	0.034	---	0.083	0.162	0.238	*****	*****	*****	31.80	31.65	*****	0.013	0.245	
1500	300.	0.041	---	0.072	0.167	0.230	*****	0.0	0.113	31.85	31.65	*****	0.018	0.239	
1530	330.	0.054	---	0.066	0.168	0.227	1.2	*****	*****	31.93	31.75	*****	0.021	0.234	
1600	360.	0.063	---	0.060	0.167	0.217	1.3	0.0	0.127	31.90	31.72	*****	0.023	0.227	
1612	372.	0.070	---	0.059	0.167	0.216	*****	*****	*****	31.89	31.70	*****	0.025	0.226	

***** NO DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

DZONE 360.0 MIN TOTAL DOSAGE = 7.94 PPM-MIN
NJ 360.0 MIN TOTAL DOSAGE = 46.75 PPM-MIN
NO2-PAN 360.0 MIN TOTAL DOSAGE = 46.36 PPM-MIN
PAN 360.0 MIN TOTAL DOSAGE = 0.0 PPM-MIN
OZONE DOSAGE GT 0.10 = 0.0 PPM-MIN
OZONE DOSAGE GT 0.08 = 0.0 PPM-MIN
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 34-E
GLASS CHAMBER
1973 NOV 6

LIGHTS ON 1030, OFF 1640 INTENSITY = 0.70 OF MAXIMUM
INITIAL RH = 51 % (31.20 DEG C) FINAL RH = 32 % (30.80 DEG C)
DASIBI FACTOR 1.01, MAST FACTOR 1.6
AT T = 0: SURROGATE HC = 520 PPBC; TOTAL NON-METHANE HC = 627 PPBC;
METHANE = 1730 PPB

CLOCK TIME (MIN)	ELAPSED OZONE (PPM)	OXIDANT (PPM)	N2O (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T SAMPLE T (DEG C)	03*NO /NO2	TOT N (PPM)	
1028	-2.	0.0	0.097	0.013	0.108	*****	*****	*****	34.19	32.12	0.0 0.110	
1030	0.	0.002	0.0	0.098	0.011	0.106	1.6	0.0	33.68	31.90	0.0 0.018	
1045	15.	0.008	0.0	0.093	0.023	0.108	1.8	*****	32.03	31.42	0.0 0.113	
1100	30.	0.012	0.0	0.073	0.037	0.108	1.8	*****	31.63	31.55	0.0 0.024	
1115	45.	0.018	0.0	0.050	0.050	0.108	*****	*****	31.53	31.53	0.0 0.110	
1130	60.	0.025	0.006	0.052	0.059	0.107	*****	0.0	0.075	31.53	31.56	0.0 0.022
1145	75.	0.036	0.026	0.048	0.060	0.105	*****	*****	31.59	31.65	0.0 0.029	
1200	90.	0.045	0.032	0.047	0.060	0.104	1.6	*****	31.56	31.65	0.0 0.135	
1216	106.	0.061	0.045	0.044	0.064	0.101	1.5	*****	31.60	31.69	0.0 0.138	
1230	120.	0.073	0.053	0.043	0.062	0.100	1.5	0.001	0.089	31.72	31.82	0.0 0.142
1300	150.	0.094	0.080	0.041	0.061	0.096	1.6	*****	31.71	31.87	0.0 0.146	
1330	180.	0.115	0.093	0.042	0.058	0.093	1.6	0.003	0.113	31.72	31.84	0.0 0.103
1400	210.	0.141	0.122	0.040	0.055	0.090	*****	*****	31.66	31.84	0.0 0.096	
1430	240.	0.163	0.130	0.038	0.054	0.082	1.5	0.004	0.126	31.59	31.84	0.0 0.116
1500	270.	0.187	0.184	0.040	0.046	0.081	*****	*****	31.78	31.80	0.0 0.161	
1530	300.	0.207	0.184	0.040	0.044	0.083	1.5	0.005	0.131	31.71	31.73	0.0 0.166
1600	330.	0.229	0.190	0.040	0.041	0.078	*****	*****	31.52	31.67	0.0 0.220	
1630	360.	0.248	0.213	0.040	0.042	0.078	1.8	0.006	0.130	31.52	31.67	0.0 0.088
1639	369.	0.254	0.219	0.041	0.041	0.077	*****	*****	31.56	31.65	0.0 0.254	

***** NO DATA TAKEN ----- DATA DISCARDED ? QUESTIONABLE DATA

OZONE	360.0	MIN TOTAL DOSAGE = 42.54 PPM-MIN
NO	360.0	MIN TOTAL DOSAGE = 16.90 PPM-MIN
NO2-PAN	360.0	MIN TOTAL DOSAGE = 18.20 PPM-MIN
PAN	360.0	MIN TOTAL DOSAGE = 0.99 PPM-MIN
OZONE DOSAGE GT 0.10 = 16.86 PPM-MIN		
OZONE DOSAGE GT 0.08 = 21.35 PPM-MIN		
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN		

SURROGATE RUN 35-E
GLASS CHAMBER
1973 NOV 7

LIGHTS ON 1130, OFF 1730 INTENSITY = 0.70 OF MAXIMUM
INITIAL RH = 48 % (31.80 DEG C) FINAL RH = 36 % (31.30 DEG C)
OZONE DATA CORRECTED FOR ZERO READING OF 0.006 PPM
DASIBI FACTOR 1.01, MAST FACTOR 1.6
AT T = 0: SURROGATE HC 533 PPBC; TOTAL NON-METHANE HC = 672 PPBC;

METHANE = 1700 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	O3+NO /NO2	TOT N (PPM)
1130	0.	0.0	0.0	0.182	0.028	0.205	*****	0.0	0.077	33.69	31.82	0.0
1145	15.	0.002	0.0	0.168	0.046	0.206	2.2	*****	*****	31.60	31.04	0.007
1200	30.	0.003	0.0	0.151	0.060	0.205	2.0	*****	*****	30.90	31.10	0.008
1215	45.	0.005	0.0	0.131	0.077	0.203	*****	*****	*****	31.06	31.52	0.029
1230	60.	0.009	0.0	0.114	0.095	0.203	*****	0.0	0.096	31.40	31.76	0.011
1245	75.	0.015	0.0	0.100	0.103	0.198	*****	*****	*****	31.50	31.81	0.015
1300	90.	0.017	0.008	0.088	0.111	0.195	*****	*****	*****	31.59	31.85	0.194
1315	105.	0.024	0.018	0.092	0.118	0.192	1.8	*****	*****	31.64	31.87	0.200
1330	120.	0.030	0.027	0.072	0.121	0.191	*****	0.000	0.104	31.72	31.89	0.193
1400	150.	0.042	0.030	0.061	0.129	0.182	*****	*****	*****	31.83	31.93	0.020
1430	160.	0.058	0.046	0.055	0.130	0.179	*****	0.001	0.127	31.85	31.97	0.191
1500	210.	0.077	0.061	0.050	0.130	0.174	*****	*****	*****	32.00	32.04	0.166
1530	240.	0.094	0.083	0.048	0.127	0.166	0.001	0.127	32.05	32.11	0.036	0.176
1600	270.	0.112	0.093	0.047	0.119	0.165	*****	*****	*****	32.13	32.11	0.044
1630	300.	0.131	0.117	0.046	0.118	0.156	*****	0.002	0.146	32.06	32.02	0.166
1700	330.	0.151	0.131	0.044	0.115	0.153	2.2	*****	*****	31.91	31.86	0.058
1730	360.	0.174	0.163	0.046	0.106	0.143	*****	0.003	0.142	31.80	31.76	0.075

***** NO DATA TAKEN

DATA DISCARDED

? QUESTIONABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 24.39 PPM-MIN
NO 360.0 MIN TOTAL DOSAGE = 26.71 PPM-MIN
NO2-PAN 350.0 MIN TOTAL DOSAGE = 39.70 PPM-MIN
PAN 360.0 MIN TOTAL DOSAGE = 0.39 PPM-MIN
OZONE DOSAGE GT 0.10 = 3.95 PPM-MIN
OZONE DOSAGE GT 0.08 = 6.47 PPM-MIN
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 36-E
GLASS CHAMBER
1973 NJV 8

LIGHTS ON 1030, OFF (NOT RECORDED) INTENSITY = 0.70 OF MAXIMUM
INITIAL RH = 48 % (31.40 DEG C) FINAL RH 37 % (31.85 DEG C)
OZONE DATA CORRECTED FOR ZERO READING OF 0.005 PPV
DASIBI FACTOR 1.01, MAST FACTOR 1.6
AT T = 0: SURROGATE HC = 541 PPBC; TOTAL NON-METHANE HC = 581 PPBC;
METHANE = 1685 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	O3*NO / NO2 (PPM)	TOT N (PPM)
1030	0.	0.0	0.0	0.197	0.036	0.229	2.2	0.0	0.011	34.11	31.96	0.0	0.233
1045	15.	0.002	0.0	0.169	0.061	0.228	*****	*****	*****	32.07	31.42	0.006	0.230
1100	30.	0.004	0.005	0.150	0.082	0.227	*****	*****	*****	31.46	31.47	0.007	0.232
1115	45.	0.008	0.013	0.132	0.094	0.221	*****	*****	*****	31.58	31.62	0.011	0.226
1130	60.	0.009	0.013	0.120	0.106	0.217	2.1	0.0	0.060	31.64	31.70	0.010	0.226
1145	75.	0.012	0.021	0.108	0.118	0.216	*****	*****	*****	31.69	31.84	0.011	0.226
1200	90.	0.014	0.026	0.097	0.120	0.215	*****	*****	*****	31.73	31.84	0.011	0.217
1215	105.	0.017	0.030	0.094	0.122	0.209	*****	*****	*****	31.72	31.86	0.013	0.216
1230	120.	0.023	0.030	0.084	0.131	0.208	1.9	0.0	0.070	31.78	31.90	0.015	0.215
1300	150.	0.030	0.034	0.073	0.136	0.204	*****	*****	*****	31.85	31.95	0.016	0.209
1330	180.	0.039	0.048	0.066	0.142	0.200	1.9	0.0	0.070	31.85	31.90	0.018	0.208
1400	210.	0.052	0.061	0.059	0.143	0.194	*****	*****	*****	31.86	31.92	0.021	0.202
1430	240.	0.062	0.069	0.056	0.143	0.191	*****	*****	0.000	0.097	31.93	0.024	0.200
1500	270.	0.075	0.080	0.049	0.143	0.189	*****	*****	*****	31.97	31.98	0.026	0.193
1530	300.	0.099	0.094	0.048	0.140	0.180	*****	*****	0.001	0.104	32.01	31.98	0.0190
1600	330.	0.103	0.099	0.049	0.131	0.176	*****	*****	*****	31.95	31.95	0.038	0.181
1630	360.	0.119	0.136	0.047	0.130	0.170	2.2	0.002	0.104	31.90	31.85	0.043	0.179

***** NO DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 16.79 PPM-MIN
NO 360.0 MIN TOTAL DOSAGE = 29.11 PPM-MIN
NO2-PAN 360.0 MIN TOTAL DOSAGE = 45.03 PPM-MIN
PAN 360.0 MIN TOTAL DOSAGE = 0.18 PPM-MIN
OZONE DOSAGE GT 0.12 = 0.38 PPM-MIN
OZONE DOSAGE GT 0.08 = 1.54 PPM-MIN
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE PUN 37-E
GLASS CHAMBER
1973 NOV 9

LIGHTS ON 1030, OFF 1631. INTENSITY = 0.70 % MAXIMUM
 INITIAL RH = 48 % (31.50 DEG C) FINAL RH = 39 % (31.81 DEG C)
 DZONE DATA CORRECTED FOR ZERO READING OF 0.012 PPM FILTER READING = 0.009 PPM
 DASIFI FACTOR 1.01, MAST FACTOR 1.6
 AT T = 0: SURROGATE HC = 561 PPBC; TOTAL NON-METHANE HC = 773 PPBC;
 METHANE = 1742 PPM

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T SAMPLE T (DEG C)	TGT N /NO2 (PPM)	TGT N /NO2 (PPM)
1030	0.	0.0	0.0	0.026	0.005	0.030	2.8	0.0	0.058	33.90	31.62	0.0
1045	15.	0.007	0.0	0.025	0.010	0.035	*****	*****	*****	31.97	31.02	0.019
1100	30.	0.013	0.028	0.006	0.035	0.035	*****	*****	*****	31.09	31.00	0.060
1115	45.	0.018	0.021	0.026	0.011	0.036	*****	*****	*****	30.83	31.21	0.044
1130	60.	0.024	0.029	0.026	0.010	0.036	*****	*****	0.072	31.11	31.52	0.067
1145	75.	0.034	0.037	0.030	0.010	0.036	*****	*****	*****	31.41	31.81	0.399
1200	90.	0.039	0.043	0.034	0.011	0.036	*****	*****	*****	31.67	31.29	0.118
1215	105.	0.057	0.051	0.031	0.011	0.040	*****	*****	*****	31.86	32.00	0.162
1230	120.	0.066	0.059	0.034	0.010	0.040	*****	*****	0.088	31.93	31.96	0.210
1303	150.	0.076	0.075	0.034	0.011	0.044	*****	*****	*****	31.82	31.86	0.227
1330	180.	0.087	0.090	0.035	0.011	0.044	*****	*****	0.104	31.78	31.71	0.282
1400	210.	0.101	0.106	0.036	0.012	0.045	*****	*****	*****	31.72	31.65	0.312
1430	240.	0.114	0.114	0.036	0.017	0.046	*****	*****	0.104	31.62	31.55	0.236
1500	270.	0.127	0.128	0.036	0.018	0.046	*****	*****	*****	31.64	31.58	0.250
1530	300.	0.139	0.141	0.036	0.018	0.047	*****	*****	0.131	31.68	31.60	0.277
1600	330.	0.151	0.157	0.037	0.018	0.049	*****	*****	*****	31.65	31.55	0.311
1630	360.	0.161	0.163	0.037	0.019	0.050	3.0	0.003	0.128	31.63	31.54	0.310

***** NO DATA TAKEN

DATA DISCARDED

QUESTIONABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 39.66 PPM-MIN
 NO2-PAN 360.0 MIN TOTAL DOSAGE = 12.01 PPM-MIN
 PAN 360.0 MIN TOTAL DOSAGE = 4.75 PPM-MIN
 OZONE DOSAGE GT 0.10 = 4.89 PPM-MIN
 OZONE DOSAGE GT 0.08 = 8.41 PPM-MIN
 NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 38-E
GLASS CHAMBER
1973 NOV 13

LIGHTS ON 1200, OFF 1603 INTENSITY = 0.70 OF MAXIMUM

INITIAL RH = 50 % (31.67 DEG C) FINAL RH = 37 % (31.41 DEG C)

OZONE DATA CORRECTED FOR ZERO READING OF 0.004 PPM

DASIBI FACTOR 1.01, MAST FACTOR 1.6

AT T = 0: SURROGATE HC = 450 PPBC; TOTAL NON-METHANE HC = 626 PPBC;
METHANE = 1660 PPM

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T SAMPLE (DEG C)	03*NO /NO2 (PPM)	TOT N (PPM)
1000	0.	0.0	0.0	0.016	0.238	1.1	0.0	*****	33.73	31.61	0.0
1015	15.	0.001	0.0	0.025	0.236	*****	*****	*****	31.90	31.15	0.009
1030	30.	0.003	0.0	0.037	0.236	*****	*****	*****	31.26	31.26	0.317
1045	45.	0.002	0.002	0.191	0.049	0.236	*****	*****	31.28	31.38	0.008
1100	60.	0.005	0.003	0.174	0.062	0.235	*****	0.0	0.073	31.45	0.014
1115	75.	0.005	0.006	0.158	0.074	0.230	1.1	*****	31.55	31.55	0.014
1130	90.	0.009	0.008	0.146	0.086	0.229	*****	*****	31.70	31.70	0.233
1145	105.	0.009	0.011	0.133	0.096	0.228	*****	*****	31.78	31.78	0.009
1200	120.	0.009	0.014	0.122	0.107	0.227	*****	0.0	31.84	31.84	0.229
1230	150.	0.016	0.018	0.107	0.119	0.217	1.1	*****	31.88	31.88	0.013
1300	180.	0.020	0.030	0.090	0.131	0.215	*****	0.0	31.92	31.92	0.010
1330	210.	0.038	0.032	0.074	0.142	0.205	*****	*****	31.96	31.96	0.229
1400	240.	0.045	0.043	0.067	0.144	0.204	*****	0.0	31.98	31.98	0.015
1430	270.	0.054	0.054	0.059	0.145	0.198	1.1	*****	31.99	31.99	0.226
1500	300.	0.068	0.067	0.052	0.144	0.192	*****	0.0	31.99	31.99	0.014
1530	330.	0.081	0.082	0.049	0.143	0.186	*****	*****	31.94	31.94	0.221
1600	360.	0.098	0.104	0.048	0.140	0.180	1.1	0.0	31.47	31.47	0.188

***** NO DATA TAKEN

DATA DISCARDED ? QUESTIONABLE DATA

PLOT

OZONE 360.0 MIN TOTAL DOSAGE = 11.89 PPM-MIN
NO2-PAN 360.0 MIN TOTAL DOSAGE = 38.38 PPM-MIN
PAN 360.0 MIN TOTAL DOSAGE = 40.12 PPM-MIN
OZONE DOSAGE GT 0-10 = 0.06 PPM-MIN
OZONE DOSAGE GT 0-0.08 = 0.38 PPM-MIN
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 39-F
GLASS CHAMBER
1973 NOV 14

LIGHTS ON 1045, OFF 1645. INTENSITY = 0.70 OF MAXIMUM
INITIAL RH = 50 % (31.68 DEG C) FINAL RH = 37 % (31.58 DEG C)
DZNT DATA CORRECTED FOR ZERO READING OF 0.005 ppm
DASIE I FACTOR 1.01,
WAST FACTOR 1.6
AT T = 0: SURROGATE HC = 607 ppbc; TOTAL NON-METHANE HC = 744 ppac;
METHANE = 1740 ppb

CLOCK TIME (MM)	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO ₂ -PAN (PPM)	NO _x -PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	$\frac{NO_2+NO}{NO_2}$ (PPM)	TOT N (PPM)
1045	0.	0.0	0.0	0.184	0.049	0.229	0.8	0.0	0.038	34.18	31.81	0.0	0.233
1100	15.	0.0	0.0	0.178	0.059	0.230	*****	*****	*****	32.83	31.74	0.0	0.236
1115	30.	0.004	0.002	0.156	0.072	0.228	*****	*****	*****	31.63	31.43	0.039	0.238
1130	45.	0.005	0.002	0.145	0.084	0.226	*****	*****	*****	31.48	31.48	0.039	0.229
1145	60.	0.008	0.008	0.132	0.095	0.225	*****	*****	*****	31.54	31.71	0.011	0.226
1200	75.	0.006	0.010	0.121	0.105	0.220	*****	*****	*****	31.77	31.77	0.027	0.227
1215	90.	0.010	0.010	0.109	0.117	0.218	*****	*****	*****	31.81	31.79	0.009	0.227
1230	105.	0.014	0.011	0.098	0.120	0.215	*****	*****	*****	31.83	31.80	0.012	0.220
1245	120.	0.019	0.021	0.091	0.129	0.213	0.8	*****	*****	31.83	31.81	0.014	0.221
1315	150.	0.024	0.026	0.074	0.133	0.204	*****	*****	*****	31.88	31.84	0.014	0.239
1345	180.	0.035	0.035	0.062	0.142	0.201	*****	*****	*****	31.85	31.85	0.016	0.206
1415	210.	0.049	0.043	0.055	0.143	0.193	0.8	*****	*****	31.90	31.94	0.019	0.200
1445	240.	0.064	0.059	0.049	0.143	0.201	*****	*****	*****	31.94	31.94	0.146	0.194
1515	270.	0.078	0.078	0.046	0.142	0.180	*****	*****	*****	31.90	31.80	0.025	0.190
1545	300.	0.098	0.086	0.042	0.140	0.175	*****	0.002	0.153	31.73	31.61	0.029	0.185
1615	330.	0.113	0.106	0.038	0.134	0.166	0.8	*****	*****	31.73	31.66	0.032	0.175
1645	360.	0.133	0.117	0.037	0.129	0.163	0.9	0.003	0.207	31.66	31.58	0.038	0.169

***** NC DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

CH4	360.0	MIN TOTAL DOSAGE = 17.02 PPM-MIN
NO ₂	360.0	MIN TOTAL DOSAGE = 29.24 PPM-MIN
NO ₂ -PAN	360.0	MIN TOTAL DOSAGE = 44.32 PPM-MIN
PAN	360.0	MIN TOTAL DOSAGE = 3.54 PPM-MIN
DZNE	DOSAGE GT 0.10 = 0.39 PPM-MIN	
DZNE	DOSAGE GT 0.08 = 2.33 PPM-MIN	
NO ₂ -PAN	DOSAGE GT 0.25 = 0.0 PPM-MIN	

SURROGATE FNU 40-E
GLASS CHAMBER
1973 NOV 15

LIGHTS ON 1130, OFF 1630. INTENSITY = 0.70 OF MAXIMUM
INITIAL RH = 49 % (31.51 DEG C) FINAL PH = 36 % (31.61 DEG C)
CLOME DATA CORRECTED FOR FILTER READING OF 0.006 PPM; INLET FITTING ADJUSTED 1031
DASIBI FACTOR 1.01, MAST FACTOR 1.6
AT T = 0: SURROGATE HC = 6.34 PPBC; TOTAL NON-METHANE HC = 715 PPBC;
METHANE = 1700 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO ₂ -PAN (PPM)	NO _x -PAN (PPM)	C ₂ (PPM)	PAN (PPM)	HCHO (PPM)	WALL T SAMPLE T (DEG C)	03*NO ₂ /NO ₂	TGT N (PPM)	
1030	0.	0.006	0.0	0.004	0.062	1.2	0.0	0.046	33.77	31.43	0.133	0.065	
1045	15.	0.003	0.003	0.049	0.020	0.065	*****	*****	31.43	30.95	0.007	0.070	
1100	30.	0.007	0.008	0.037	0.034	0.064	*****	*****	31.02	31.08	0.008	0.071	
1115	45.	0.024	0.008	0.034	0.037	0.064	*****	*****	31.13	31.32	0.022	0.071	
1130	60.	0.040	0.037	0.026	0.040	0.062	*****	0.060	31.22	31.41	0.027	0.066	
1145	75.	0.055	0.053	0.026	0.044	0.062	*****	*****	31.44	31.51	0.033	0.071	
1200	90.	0.075	0.072	0.024	0.039	0.059	*****	*****	31.53	31.54	0.046	0.065	
1215	105.	0.083	0.080	0.025	0.038	0.057	*****	*****	31.66	31.58	0.055	0.065	
1230	120.	0.109	0.094	0.026	0.036	0.056	*****	0.003	0.085	31.64	31.62	0.080	0.066
1300	150.	0.132	0.117	0.026	0.034	0.056	1.1	*****	31.71	31.68	0.102	0.065	
1315	165.	0.159	0.141	0.026	0.031	0.054	*****	0.105	31.79	31.75	0.135	0.062	
1400	210.	0.182	0.162	0.026	0.030	0.054	*****	*****	31.77	31.75	0.160	0.062	
1430	240.	0.207	0.186	0.029	0.029	0.052	1.1	0.007	0.114	31.63	31.67	0.206	0.065
1500	270.	0.220	0.192	0.028	0.029	0.053	*****	*****	31.57	31.62	0.211	0.064	
1530	300.	0.235	0.206	0.030	0.027	0.051	1.1	*****	31.62	31.61	0.259	0.065	
1600	330.	0.249	0.221	0.032	0.026	0.051	*****	*****	31.64	31.61	0.313	0.066	
1630	360.	0.255	0.227	0.032	0.026	0.051	1.1	0.008	0.130	31.65	31.61	0.322	0.066

***** NC DATA TAKEN ---- DATA DISCARDED ---- ? QUESTIONABLE DATA

DOSAGE = 52.16 PPB-MIN
NC 360.0 MIN TOTAL DOSAGE = 10.81 PPB-MIN
NO₂-PAN 360.0 MIN TOTAL DOSAGE = 11.18 PPB-MIN
PAN 360.0 MIN TOTAL DOSAGE = 1.62 PPB-MIN
OZONE DOSAGE GT 0.10 = 23.06 PPB-MIN
DZONE DOSAGE GT 0.08 = 28.06 PPB-MIN
NO₂-PAN DOSAGE GT 0.25 = 0.0 PPB-MIN

SURROGATE RUN 41-E
GLASS CHAMBER
1973 NOV 27

LIGHTS ON 0945, OFF 1549 INTENSITY = 0.70 OF MAXIMUM
 INITIAL RH = 50 % (31.31 DEG C) FINAL RH = 52 % (25.9 DEG C)
 PAN NOT RECORDED
 DASIBI FACTOR 1.01, MAST FACTOR 1.6
 AT T = 0: SURROGATE HC = 579 PPBC; TOTAL NON-METHANE HC = 659 PPBC;
 METHANE = 1680 ppb

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO ₂ -PAN (PPM)	CO (PPM)	HCHO (PPM)	WALL T SAMPLE T (DEG C)	TOT N (PPM)
									03*NO /NO ₂
	945	0.	0.0	0.059	0.001	0.060	1.9	0.033	34.07
	1000	15.	0.0	0.049	0.012	0.061	*****	31.34	32.18
	1015	30.	0.005	0.002	0.040	0.024	*****	31.16	30.89
	1030	45.	0.020	0.027	0.038	0.026	0.060	*****	30.97
	1045	60.	0.035	0.035	0.037	0.026	0.061	*****	31.10
	1100	75.	0.049	0.061	0.025	0.025	0.061	1.8	31.31
	1115	90.	0.065	0.069	0.037	0.025	0.061	*****	31.42
	1130	105.	0.078	0.090	0.040	0.026	0.062	*****	31.40
	1145	120.	0.091	0.096	0.042	0.025	0.062	*****	31.42
	1215	150.	0.112	0.128	0.046	0.025	0.062	*****	31.39
	1245	180.	0.133	0.133	0.047	0.024	0.064	*****	31.38
	1315	210.	0.148	0.144	0.046	0.024	0.066	1.7	31.31
	1345	240.	0.165	0.160	0.048	0.024	0.067	*****	31.40
	1415	270.	0.175	0.187	0.048	0.024	0.070	*****	31.24
	1445	300.	0.189	0.189	0.048	0.024	0.070	1.7	31.18
	1515	330.	0.193	0.214	0.049	0.024	0.071	*****	31.10
	1545	360.	0.204	0.214	0.049	0.024	0.072	1.8	31.23
									31.35

***** NO DATA TAKEN ---- DATA DISCARDED ---- ? QUESTIONABLE DATA

OZONE	360.0	MIN TOTAL DOSAGE	= 43.48 PPM-MIN
NO	360.0	MIN TOTAL DOSAGE	= 17.35 PPM-MIN
NO ₂ -PAN	360.0	MIN TOTAL DOSAGE	= 7.40 PPM-MIN
OZONE DOSAGE GT 0.10			= 14.16 PPM-MIN
OZONE DOSAGE GT 0.08			= 16.84 PPM-MIN
NO ₂ -PAN DOSAGE GT 0.25			= 0.0 PPM-MIN

SURROGATE RUN 42-E
GLASS CHAMBER
1973 NOV 29

LIGHTS ON 0915, OFF 1515 INTENSITY = 0.70 OF MAXIMUM
INITIAL RH = 50 % (31.12 DEG C) FINAL RH = 33 % (32.21 DEG C)
PAN NOT RECORDED
DASIBI FACTOR 1.01, MAST FACTOR 1.6
AT T = 0: SURROGATE HC = 281 PPBC; TOTAL NON-METHANE HC = 353 PPBC;
METHANE = 1600 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO /NO2	TOT N (PPM)
915	0.	0.0	0.0	0.062	0.031	0.362	1.2	0.011	33.71	31.62	0.064	0.0
930	15.	0.0	0.0	0.060	0.011	0.066	***	***	31.60	30.94	0.3	0.071
945	30.	0.0	0.0	0.054	0.020	0.071	***	***	30.91	30.90	0.0	0.074
1000	45.	0.004	0.0	0.048	0.026	0.371	***	***	30.95	31.07	0.007	0.074
1015	60.	0.012	0.0	0.044	0.032	0.071	***	0.023	31.04	31.12	0.017	0.077
1030	75.	0.022	0.005	0.041	0.035	0.072	1.2	***	31.10	31.21	0.026	0.076
1045	90.	0.031	0.010	0.033	0.036	0.072	***	***	31.16	31.30	0.033	0.076
1100	105.	0.039	0.030	0.038	0.036	0.072	***	***	31.29	31.46	0.042	0.077
1115	120.	0.044	0.034	0.037	0.036	0.072	***	0.050	31.41	31.60	0.046	0.077
1145	150.	0.065	0.061	0.038	0.037	0.072	1.1	***	31.66	31.85	0.367	0.080
1215	180.	0.073	0.069	0.038	0.036	0.072	***	0.067	31.68	31.81	0.078	0.079
1245	210.	0.100	0.088	0.038	0.036	0.072	***	***	31.64	31.74	0.107	0.080
1315	247.	0.119	0.098	0.040	0.036	0.072	***	0.070	31.64	31.73	0.131	0.083
1352	277.	0.141	0.128	0.042	0.035	0.072	***	***	31.68	31.66	0.171	0.084
1415	300.	0.153	0.131	0.042	0.035	0.071	***	0.077	31.62	31.60	0.184	0.084
1445	330.	0.170	0.157	0.043	0.034	0.071	***	***	31.60	31.58	0.218	0.085
1515	360.	0.184	0.165	0.046	0.029	0.072	1.1	0.051	31.64	31.58	0.291	0.082

***** NO DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 30.58 PPM-MIN
NO 360.0 MIN TOTAL DOSAGE = 15.67 PPM-MIN
NO2-PAN 360.0 MIN TOTAL DOSAGE = 10.66 PPM-MIN
OZONE USAGE GT 0.10 = 6.62 PPM-MIN
OZONE USAGE GT 0.08 = 9.92 PPM-MIN
NO2-PAN USAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 43-E
GLASS CHAMBER
1973 NOV 30

LIGHTS ON 1015, OFF (NOT RECORDED) INTENSITY = 0.70 OF MAXIMUM
 INITIAL RH = 48 % (31.04 DEG C)
 DASIBI FACTOR 1.01, MAST FACTOR 1.⁶
 AT T = 0: SURROGATE HC = 331 PPBC; TOTAL NON-METHANE HC = 402 PPBC;
 METHANE = 1665 PPB

CLOCK TIME	ELAPSED TIME(MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO ₂ -PAN (PPM)	NO _x -PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO /NO ₂	TOT N (PPM)
1015	0.	0.0	0.0	0.010	0.126	1.3	0.0	0.017	34.12	31.71	31.71	0.0	0.130
1030	15.	0.0	0.0	0.014	0.018	0.130	*****	*****	32.56	31.76	31.76	0.0	0.132
1045	30.	0.0	0.0	0.025	0.131	0.131	*****	*****	31.66	31.41	31.41	0.0	0.133
1100	45.	0.0	0.0	0.097	0.036	0.131	*****	*****	31.29	31.22	31.22	0.0	0.133
1115	60.	0.001	0.0	0.090	0.046	0.131	*****	0.0	0.037	31.30	31.17	0.002	0.136
1130	75.	0.004	0.0	0.083	0.050	0.131	*****	*****	31.21	31.21	31.21	0.007	0.133
1145	90.	0.007	0.003	0.073	0.060	0.130	*****	*****	31.23	31.23	31.23	0.013	0.132
1200	105.	0.012	0.010	0.068	0.064	0.128	1.-2	*****	31.30	31.21	31.21	0.017	0.132
1215	120.	0.018	0.011	0.064	0.068	0.126	*****	0.0	0.063	31.35	31.30	0.017	0.132
1230	135.	0.021	0.018	0.061	0.072	0.126	*****	*****	31.49	31.43	31.43	0.018	0.133
1245	150.	0.029	0.032	0.059	0.073	0.125	*****	*****	31.60	31.56	31.56	0.024	0.132
1315	180.	0.040	0.038	0.053	0.076	0.124	*****	0.0	0.090	31.69	31.67	0.028	0.128
1345	210.	0.058	0.058	0.062	0.074	0.119	*****	*****	31.75	31.70	31.70	0.039	0.125
1415	243.	0.071	0.077	0.050	0.075	0.118	*****	0.001	0.091	31.81	31.79	0.048	0.126
1445	270.	0.090	0.093	0.049	0.071	0.116	*****	*****	31.83	31.77	31.77	0.062	0.120
1515	300.	0.104	0.106	0.049	0.111	0.111	*****	0.112	31.77	31.69	31.69	0.074	0.120
1545	330.	0.124	0.128	0.048	0.108	0.108	*****	*****	31.75	31.65	31.65	0.092	0.114
1615	360.	0.144	0.048	0.061	0.106	1.-3	0.002	0.116	31.65	31.58	31.58	0.114	0.110

***** NO DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

DZONE 360.0 MIN TOTAL DOSAGE = 18.38 PPM-MIN
 NO 360.0 MIN TOTAL DOSAGE = 23.32 PPM-MIN
 NO₂-PAN 360.0 MIN TOTAL DOSAGE = 22.08 PPM-MIN
 PAN 360.0 MIN TOTAL DOSAGE = 0.19 PPM-MIN
 DZONE DOSAGE GT 0.10 = 1.51 PPM-MIN
 DZONE DOSAGE GT 0.08 = 3.31 PPM-MIN
 NO₂-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 44-E
GLASS CHAMBER
1973 DEC 3

LIGHTS ON 0930, OFF (NOT RECORDED) INTENSITY = 0.70 OF MAXIMUM
 INITIAL RH = 51 % (31.81 DEG C) FINAL RH = 47 % (28.5 DEG C)
 AMBIENT (IN LAB) NO_x = 0.08 ppm AT 1147 HOURS
 DASIBI FACTOR 1.01, MAST FACTOR 1.6
 AT T = 0: SURROGATE HC = 332 ppbc; TOTAL NON-METHANE HC = 436 ppbc;
 METHANE = 1760 ppb

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT NO (PPM)	NO ₂ -PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO /NO ₂	TOT N (PPM)
930	0.	0.0	0.0	0.037	0.001	0.037	0.4	0.0	0.028	34.02	31.76
945	15.	0.0	0.0	0.038	0.001	0.038	*****	*****	*****	0.0	0.040
1000	30.	0.0	0.0	0.041	0.001	0.043	0.4	*****	*****	0.0	0.042
1015	45.	0.002	0.0	0.043	0.001	0.046	*****	*****	*****	0.073	0.044
1030	60.	0.006	0.0	0.046	0.004	0.048	*****	0.0	0.050	31.54	31.73
1045	75.	0.009	0.0	0.047	0.001	0.048	*****	*****	*****	31.78	32.00
1100	90.	0.014	0.003	0.047	0.007	0.048	*****	*****	*****	31.94	32.05
1115	105.	0.020	0.011	0.047	0.003	0.049	*****	*****	*****	32.00	32.00
1130	120.	0.025	0.018	0.048	0.003	0.050	0.4	0.000	0.078	32.00	31.96
1200	150.	0.037	0.030	0.072	0.003	0.074	*****	*****	*****	32.02	32.00
1230	180.	0.047	0.034	0.050	0.008	0.067	0.5	0.000	0.102	32.00	31.95
1300	210.	0.058	0.043	0.058	0.009	0.063	*****	*****	*****	32.00	31.95
1330	240.	0.068	0.059	0.058	0.010	0.062	0.4	0.001	0.107	31.97	31.90
1400	270.	0.078	0.067	0.050	0.010	0.065	*****	*****	*****	31.85	31.78
1430	300.	0.088	0.074	0.060	0.012	0.067	0.4	0.001	0.104	31.81	31.74
1500	330.	0.099	0.083	0.069	0.024	0.068	0.5	*****	*****	31.82	31.78
1530	360.	0.108	0.096	0.060	0.010	0.069	0.5	0.001	0.116	31.35	0.618

***** NG DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

OZONE	360.0	MIN TOTAL DOSAGE	=	17.20	PPM-MIN
NO	360.0	MIN TOTAL DOSAGE	=	19.66	PPM-MIN
NO ₂ -PAN	360.0	MIN TOTAL DOSAGE	=	2.73	PPM-MIN
PAN	360.0	MIN TOTAL DOSAGE	=	0.21	PPM-MIN
OZONE DOSAGE GT 0.10	=	0.12	PPM-MIN		
OZONE DOSAGE GT 0.08	=	1.23	PPM-MIN		
NO ₂ -PAN DOSAGE GT 0.25	=	0.0	PPM-MIN		

SURROGATE RUN 45-E
GLASS CHAMBER
1973 DEC 13

LIGHTS ON 1030, OFF 1635 INTENSITY = 0.70 OF MAXIMUM
INITIAL RH = 50 % (31.52 DEG C) FINAL RH = 33 % (30.76 DEG C)
TECO USED TO MONITOR NOX
PAN NOT RECORDED
DASBII FACTOR 1.01, MAST FACTOR 1.6
AT T = 0: SURROGATE HC = 349 PPBC; TOTAL NON-METHANE HC = 433 PPBC;
METHANE = 1600 PPB

CLOCK TIME (MM:SS)	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	HCHO (PPM)	WALL T SAMPLE T (DEG C)	WALL T (DEG C)	03*NO /NO2 (PPM)	TOT N (PPM)
1030	0.	0.0	0.0	0.133	0.017	0.150	2.2	0.057	34.22	32.06	0.0	0.150
1045	15.	0.0	0.0	0.122	0.026	0.146	*****	*****	32.35	31.64	0.0	0.149
1100	30.	0.0	0.0	0.112	0.034	0.145	*****	*****	31.56	31.80	0.0	0.145
1115	45.	0.0	0.0	0.101	0.041	0.143	*****	*****	31.68	32.10	0.0	0.142
1130	60.	0.002	0.0	0.090	0.052	0.143	*****	0.045	32.40	31.82	0.004	0.142
1145	75.	0.003	0.0	0.082	0.056	0.140	*****	*****	32.11	32.65	0.004	0.138
1200	90.	0.006	0.0	0.073	0.065	0.140	*****	*****	32.19	32.62	0.007	0.136
1216	106.	0.007	*****	0.065	0.071	0.137	*****	*****	32.36	32.51	0.006	0.136
1230	120.	0.010	*****	0.058	0.076	0.134	*****	*****	32.37	32.37	0.008	0.133
1316	166.	0.021	*****	0.041	0.088	0.128	*****	*****	32.17	32.13	0.010	0.128
1330	180.	0.024	*****	0.037	0.086	0.125	*****	*****	32.10	32.05	0.010	0.124
1400	210.	0.033	0.030	0.030	0.029	0.122	*****	*****	31.95	31.87	0.010	0.121
1430	240.	0.045	0.058	0.024	0.092	0.118	*****	0.073	31.98	31.96	0.012	0.116
1500	270.	0.059	0.059	0.019	0.095	0.114	2.1	*****	32.02	31.96	0.012	0.114
1530	300.	0.071	0.066	0.017	0.094	0.109	*****	0.100	31.89	31.82	0.013	0.110
1600	330.	0.087	0.083	0.014	0.089	0.103	*****	*****	31.96	31.93	0.014	0.103
1630	360.	0.100	0.110	0.012	0.088	0.100	2.1	0.102	31.92	31.93	0.014	0.100

***** NO DATA TAKEN ---- DATA DISCARDED

? QUESTIONABLE DATA

PLCT

OZONE	360.0	MIN TOTAL DOSAGE	= 12.36 PPM-MIN
N, J	360.0	MIN TOTAL DOSAGE	= 18.09 PPM-MIN
NO2-PAN	360.0	MIN TOTAL DOSAGE	= 26.99 PPM-MIN
OZONE DOSAGE GT 0.10	= 0.0	PPM-MIN	
OZONE DOSAGE GT 0.08	= 0.51	PPM-MIN	
NO2-PAN DOSAGE GT 0.25	= 0.0	PPM-MIN	

SURROGATE RUN 46-E
GLASS CHAMBER
1973 DEC 18

LIGHTS ON 1015, OFF 1615 INTENSITY = 0.70 OF MAXIMUM

INITIAL RH = 67 % (29.84 DEG C) FINAL RH (NOT RECORDED)

TECO USED TO MONITOR NOX

PAN NOT RECORDED

DASIBI FACTOR 1.01, MAST FACTOR 1.6

AT T = 0: SURROGATE HC = 42 PPBC; TOTAL NON-METHANE HC = 78 PPBC;

METHANE = 1550 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO ₂ -PAN (PPM)	CO (PPM)	HCHO (PPM)	WALL T SAMPLE T (DEG C)	NO ₂ *NO / NO ₂	TOT N (PPM)
1015	0.	0.0	0.0	0.005	0.005	0.060	0.4	33.96	31.61	0.0
1032	15.	0.0	0.0	0.007	0.007	0.060	*****	*****	33.42	0.058
1045	30.	0.0	0.0	0.044	0.014	0.059	*****	*****	32.24	0.059
1100	45.	0.001	0.002	0.041	0.017	0.058	*****	*****	31.22	0.002
1115	60.	0.003	0.003	0.036	0.022	0.059	*****	*****	31.10	0.058
1130	75.	0.005	0.006	0.034	0.024	0.059	*****	*****	31.03	0.005
1145	90.	0.007	0.010	0.032	0.024	0.056	*****	*****	31.06	0.058
1200	105.	0.009	0.011	0.030	0.026	0.055	*****	*****	31.15	0.010
1215	120.	0.011	0.014	0.029	0.026	0.056	*****	*****	31.19	0.057
1245	150.	0.016	0.019	0.026	0.029	0.055	*****	*****	31.26	0.012
1315	180.	0.022	0.026	0.024	0.030	0.055	*****	*****	31.22	0.015
1345	210.	0.028	0.030	0.022	0.031	0.053	0.5	*****	31.30	0.054
1415	240.	0.031	0.034	0.024	0.029	0.050	*****	*****	31.24	0.020
1445	270.	0.039	0.035	0.022	0.029	0.050	*****	*****	31.22	0.053
1515	300.	0.043	0.045	0.019	0.029	0.048	*****	*****	31.32	0.023
1545	330.	0.052	0.048	0.018	0.029	0.047	0.5	*****	31.24	0.051
1615	360.	0.057	0.059	0.018	0.029	0.046	*****	*****	31.36	0.049
							0.008	0.008	31.40	0.029
									31.38	0.048

***** NO DATA TAKEN ----- DATA DISCARDED ? QUESTIONABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 8.65 PPM-MIN
NO 360.0 MIN TOTAL DOSAGE = 10.31 PPM-MIN
NO₂-PAN 360.0 MIN TOTAL DOSAGE = 8.86 PPM-MIN
OZONE DOSAGE GT 0.10 = 0.0 PPM-MIN
OZONE DOSAGE GT 0.08 = 0.0 PPM-MIN
NO₂-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 47-E
GLASS CHAMBER
1973 DEC 19

LIGHTS ON 1030, OFF (NOT RECORDED) INTENSITY = 0.70 OF MAXIMUM

INITIAL RH = 58 % (31.35 DEG C) FINAL RH (NOT RECORDED)

TECO USED TO MONITOR NJX

DASIBI FACTOR 1.01, MAST FACTOR 1.6

AT T = 0: SURROGATE HC = 328 PPBC; TOTAL NON-METHANE HC = 370 PPBC;

METHANE = 1790 PPB

CLOCK TIME	ELAPSED TIME	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO2 /NO2 (%)	TOT N (PPM)
1030	0.	0.0	*****	0.002	0.012	0.8	0.0	0.011	33.57	31.43	0.012	0.0
1045	15.	0.0	*****	0.001	0.002	0.013	*****	*****	31.54	30.86	0.013	0.0
1100	30.	0.0	*****	0.011	0.002	0.013	*****	*****	31.86	30.69	0.013	0.0
1115	45.	0.032	*****	0.011	0.004	0.014	*****	*****	31.81	31.74	0.006	0.014
1130	60.	0.006	*****	0.011	0.004	0.014	*****	0.0	30.97	30.02	0.018	0.014
1145	75.	0.016	*****	0.012	0.005	0.016	0.8	*****	0.036	31.02	0.023	0.017
1200	90.	0.016	*****	0.012	0.004	0.016	*****	*****	31.12	31.08	0.054	0.016
1215	105.	0.021	*****	0.012	0.005	0.017	*****	*****	31.19	31.14	0.053	0.017
1230	120.	0.026	*****	0.012	0.005	0.017	*****	0.0	0.029	31.26	0.066	0.017
1300	150.	0.036	*****	0.012	0.006	0.018	*****	*****	31.24	31.29	0.073	0.018
1330	180.	0.048	*****	0.012	0.006	0.018	*****	0.0	0.073	31.42	0.097	0.018
1400	210.	0.059	0.035	0.012	0.007	0.019	0.8	*****	*****	31.51	0.107	0.018
1430	240.	0.068	0.042	0.013	0.006	0.019	0.0	0.096	0.001	31.62	0.149	0.020
1500	270.	0.078	0.053	0.013	0.007	0.020	*****	*****	0.001	31.74	0.147	0.022
1530	300.	0.086	0.075	0.013	0.007	0.020	*****	0.002	0.131	31.76	0.167	0.022
1600	330.	0.097	0.075	0.013	0.008	0.021	*****	*****	0.129	31.77	0.160	0.023
1630	360.	0.105	0.078	0.014	0.008	0.022	0.8	0.002	0.129	31.75	0.189	0.024

***** NO DATA TAKEN

? QUESTIONABLE DATA

? DATA DISCARDED

OZONE 360.0 MIN TOTAL DOSAGE = 17.13 PPM-MIN
NO 360.0 MIN TOTAL DOSAGE = 4.41 PPM-MIN
NO2-PAN 360.0 MIN TOTAL DOSAGE = 2.02 PPM-MIN
PAN 360.0 MIN TOTAL DOSAGE = 0.22 PPM-MIN
DZONE DOSAGE GT 0.10 = 0.08 PPM-MIN
OZONE DOSAGE GT 0.08 = 1.06 PPM-MIN
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 48-E
GLASS CHAMBER
1973 DEC 20

LIGHTS ON 0945, OFF 1945 INTENSITY = 0.70 OF MAXIMUM
 INITIAL RH = 51 % DEG C) FINAL RH = 39 % (30.67 DEG C)
 TECO USED TO MONITOR NOX
 DASIGI FACTOR 1.01, MAST FACTOR 1.⁶
 AT T = 0: SURROGATE HC = 313 PPBC; TOTAL NON-METHANE HC = 350 PPBC;
 METHANE = 1630 PPB

CLOCK TIME	ELAPSED TIME [MIN]	ZZONE	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	U-N3 /NDO2 (PPM)
945	0.	0.0	0.0	0.074	0.002	0.077	0.6	0.0	33.78	31.55	0.077
1000	15.	0.0	0.0	0.070	0.010	0.079	*****	*****	31.68	30.92	0.079
1015	30.	0.0	0.0	0.062	0.017	0.079	*****	*****	31.13	30.97	0.0
1030	45.	0.001	0.0	0.054	0.024	0.079	*****	*****	31.14	31.12	0.002
1045	60.	0.005	0.002	0.046	0.029	0.079	0.0	0.006	31.25	31.30	0.078
1100	75.	0.010	0.019	0.034	0.041	0.076	*****	*****	31.35	31.44	0.008
1115	90.	0.015	0.036	0.038	0.038	0.074	*****	*****	31.41	31.44	0.012
1130	105.	0.021	0.031	0.042	0.042	0.074	*****	*****	31.48	31.48	0.014
1145	120.	0.028	0.027	0.043	0.043	0.072	0.5	0.024	31.43	31.41	0.074
1215	150.	0.043	0.042	0.024	0.043	0.068	*****	*****	31.45	31.48	0.024
1245	180.	0.061	0.061	0.022	0.042	0.065	*****	0.001	0.073	31.50	0.067
1315	210.	0.080	0.083	0.020	0.042	0.062	*****	*****	31.50	31.68	0.031
1346	241.	0.102	0.098	0.019	0.039	0.059	*****	0.038	31.90	31.90	0.055
1415	270.	0.119	0.115	0.019	0.037	0.056	*****	0.002	32.13	31.96	0.062
1445	300.	0.139	0.152	0.017	0.034	0.052	0.6	0.002	0.070	32.18	0.053
1515	336.	0.162	0.157	0.017	0.030	0.047	*****	0.003	32.06	31.91	0.050
1545	360.	0.182	0.176	0.017	0.029	0.046	0.0	0.004	0.063	32.05	0.105
1645	420.	0.217	0.208	0.016	0.026	0.041	*****	0.004	32.28	31.95	0.049
1745	480.	0.247	0.245	0.016	0.023	0.039	*****	0.005	0.094	31.99	0.168
1845	540.	0.268	0.265	0.016	0.021	0.034	*****	0.8	0.036	31.41	0.197
										31.54	C.042
										31.04	C.042
										30.62	0.222

***** NO DATA TAKEN ----- DATA DISCARDED ----- DATA QUESTIONABLE DATA

OZONE	360.0	MIN	TOTAL	DOSAGE	=	25.31	PPM-MIN
NU	360.0	MIN	TOTAL	DOSAGE	=	10.69	PPM-MIN
N2O-PAN	360.0	MIN	TOTAL	DOSAGE	=	12.33	PPM-MIN
PAN	360.0	MIN	TOTAL	DOSAGE	=	0.41	PPM-MIN
OZONE	540.0	MIN	TOTAL	DOSAGE	=	69.31	PPM-MIN
OZONE	DOSE	GT	0.10	=	4.88	PPM-MIN	
JZON	DOSE	GT	0.08	=	7.57	PPM-MIN	
N2O-PAN	DOSE	GT	0.25	=	0.00	PPM-MIN	

SURROGATE RUN 49-G
GLASS CHAMBER
1974 APR 3

LIGHTS ON 1100, OFF 1700 INTENSITY = 70% OF MAXIMUM
 INITIAL RH = 43% (30.20 DEG C) FINAL RH = 31% (31.60 DEG C)
 INITIAL NOX AND NO VALUES READ IN MANUAL MODE, NO2 IS DIFFERENCE
 MAST FACTOR 1.76, CO FACTOR 2.84/26.7, PAN CALIBR. 3
 AT T = 0: SURROGATE HC = 2471 PPBC; TOTAL NON-METHANE HC = 2592 PPBC;
 METHANE = 2910 PPB

CLOCK TIME	ELAPSED TIME(MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO /NO2	TOT N (PPM)
1100	0.	0.0	0.0	0.266	0.053	0.319	*****	0.0	32.46	30.64	0.0	0.319
1115	15.	0.0	0.018	0.235	0.083	0.321	*****	*****	31.20	30.46	0.0	0.319
1130	30.	0.001	0.026	0.188	0.126	0.312	*****	*****	30.22	30.27	0.001	0.316
1145	45.	0.009	0.039	0.134	0.165	0.303	*****	*****	30.13	30.32	0.007	0.302
1200	60.	0.020	0.055	0.096	0.201	0.297	0.002	0.126	30.29	30.57	0.010	0.299
1215	75.	0.039	0.077	0.062	0.221	0.283	*****	*****	30.61	30.91	0.011	0.287
1230	90.	0.064	0.102	0.047	0.222	0.269	9.1	*****	30.78	31.01	0.013	0.275
1245	105.	0.090	0.134	0.036	0.222	0.258	*****	*****	30.81	30.97	0.015	0.263
1300	120.	0.162	0.216	0.245	0.216	0.164	0.009	0.164	31.00	31.00	0.015	0.254
1315	135.	0.141	0.185	0.024	0.212	0.236	*****	*****	31.02	31.02	0.016	0.246
1330	150.	0.168	0.209	0.023	0.206	0.228	8.7	*****	30.50	31.05	0.019	0.239
1400	180.	0.216	0.264	0.019	0.195	0.213	8.6	*****	0.159	31.17	0.021	0.226
1430	210.	0.264	0.312	0.013	0.192	0.204	8.4	0.012	0.269	31.26	0.018	0.217
1500	240.	0.310	0.357	0.014	0.176	0.183	8.3	*****	31.43	31.64	0.025	0.205
1530	270.	0.355	0.389	0.013	0.153	0.163	8.2	0.017	0.282	31.53	0.031	0.187
1600	300.	0.400	0.449	0.012	0.138	0.149	8.1	*****	31.62	31.90	0.035	0.168
1630	330.	0.450	0.489	0.013	0.125	0.135	7.9	0.019	0.262	31.65	0.048	0.157
1700	360.	0.484	0.537	0.012	0.096	0.107	7.8	0.036	0.332	31.48	0.060	0.144

***** NO DATA TAKEN ----- DATA DISCARDED

? QUESTIONABLE DATA

PLOT

OZONE 360.0 MIN TOTAL DOSAGE = 78.06 PPM-MIN
 NO 360.0 MIN TOTAL DOSAGE = 18.03 PPM-MIN
 NO2-PAN 360.0 MIN TOTAL DOSAGE = 60.88 PPM-MIN
 PAN 360.0 MIN TOTAL DOSAGE = 4.18 PPM-MIN
 OZONE DOSAGE GT 0.10 = 4*.95 PPM-MIN
 OZONE DOSAGE GT 0.08 = 55.06 PPM-MIN
 NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 50-G
GLASS CHAMBER
1974 APR 4

LIGHTS ON 1045, OFF 1650, INTENSITY = 70% OF MAXIMUM
 INITIAL RH = 48% 130.96 DEG C FINAL RH = 31% 131.95 DEG C
 WAST FACTOR 1.76, CO FACTOR 2.84/26.3, PAN CALIBR. 3
 AT T = 0: SURROGATE HC = 1956 PPBC; TOTAL NON-METHANE HC = 2088 PPBC;
 METHANE = 2820 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO ₂ -PAN (PPM)	NO ₂ -N ₂ X-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO ₂ /NO ₂	TCT N (PPM)
1045	0.	0.0	0.0	0.040	0.337	7.1	0.0	0.050	33.86	31.81	31.81	0.0	0.337
1100	15.	0.0	0.0	0.062	0.334	7.0	*****	*****	31.67	30.97	30.97	0.0	0.338
1115	30.	0.0	0.0	0.065	0.334	*****	*****	*****	30.82	30.86	30.86	0.0	0.330
1130	45.	0.0	0.004	0.202	0.126	0.325	6.9	*****	30.90	31.20	31.20	0.006	0.328
1145	60.	0.007	0.012	0.162	0.156	0.316	6.9	0.0	0.131	31.07	31.40	0.007	0.318
1200	75.	0.012	0.021	0.130	0.178	0.304	6.8	*****	31.17	31.49	31.49	0.009	0.308
1215	90.	0.021	0.033	0.096	0.200	0.296	6.7	*****	31.17	31.34	31.34	0.010	0.298
1230	105.	0.033	0.049	0.073	0.211	0.284	6.6	*****	*****	*****	*****	0.011	0.287
1245	120.	0.048	0.063	0.059	0.218	0.274	6.6	0.004	0.203	31.12	31.22	0.013	0.281
1315	150.	0.084	0.102	0.037	0.216	0.254	6.4	*****	*****	31.14	31.34	0.014	0.259
1345	180.	0.122	0.144	0.026	0.203	0.240	6.3	0.008	0.233	31.13	31.23	0.016	0.242
1415	210.	0.164	0.183	0.024	0.190	0.213	6.2	*****	*****	31.21	31.39	0.021	0.228
1445	240.	0.204	0.220	0.019	0.175	0.196	6.0	0.019	*****	31.05	31.19	0.022	0.214
1515	270.	0.245	0.262	0.018	0.158	0.175	6.0	0.023	0.227	31.30	31.50	0.028	0.199
1545	300.	0.287	0.312	0.014	0.144	0.157	5.9	*****	*****	31.30	31.41	0.029	0.185
1615	330.	0.330	0.347	0.013	0.129	0.141	5.8	0.030	0.234	31.35	31.48	0.034	0.172
1645	360.	0.372	0.387	0.012	0.124	0.131	5.7	*****	*****	31.55	31.70	0.036	0.166

***** NO DATA TAKEN ---- DATA DISCARDED

? QUESTIONABLE DATA

PLOT

OZONE 360.0 MIN TOTAL DOSAGE = 50.89 PPM-MIN
 NO₂ 360.0 MIN TOTAL DOSAGE = 26.05 PPM-MIN
 PAN 360.0 MIN TOTAL DOSAGE = 58.96 PPM-MIN
 OZONE DOSAGE GT 0.10 = 3.52 PPM-MIN
 OZONE DOSAGE GT 0.08 = 26.64 PPM-MIN
 NO₂-PAN DOSAGE GT 0.25 = 30.66 PPM-MIN
 PAN 0.0 PPM-MIN

SURROGATE RUN 51-G
GLASS CHAMBER
1974 APR 5

LIGHTS ON 1030, OFF 1638 INTENSITY = 70% OF MAXIMUM
 INITIAL RH = 50% (31.46 DEG C) FINAL RH = 35% (32.57 DEG C)
 MAST FACTOR 1.76, CO 10 ppm FULL SCALE, PAN CALIBR. 3
 ATT = 0; SURROGATE HC = 645 ppbc; TOTAL NONMETHANE HC = 802 ppbc;
 METHANE = 1750 ppm

CLOCK TIME	ELAPSED TIME(MIN)	OZONE (ppm)	OXIDANT (ppm)	N ₂ (ppm)	NOX-PAN (ppm)	CO (ppm)	PAN (ppm)	HCHO (ppm)	WALL T. (DEG C)	SAMPLE T (DEG C)	03*NO ₂ /NO ₂	TCT N (ppm)
1030	0.	0.0	0.005	0.056	0.005	0.061	2.0	0.0	33.49	31.46	0.0	0.061
1045	15.	0.004	0.035	0.040	0.021	0.061	2.0	*****	32.60	31.55	0.007	0.061
1100	30.	0.014	0.019	0.025	0.035	0.059	2.0	*****	32.28	31.98	0.010	0.061
1115	45.	0.034	0.040	0.017	0.039	0.056	2.0	0.002	31.98	32.04	0.014	0.056
1130	60.	0.059	0.065	0.013	0.039	0.053	2.0	0.002	31.79	32.12	0.020	0.054
1145	75.	0.083	0.086	0.012	0.039	0.051	2.0	*****	31.74	31.95	0.024	0.054
1200	90.	0.099	0.106	0.012	0.037	0.048	2.0	*****	31.64	31.79	0.032	0.053
1215	105.	0.118	0.125	0.010	0.036	0.046	2.0	*****	31.53	31.72	0.031	0.053
1230	120.	0.136	0.143	0.010	0.034	0.044	2.0	0.005	31.47	31.67	0.038	0.049
1300	150.	0.169	0.178	0.010	0.031	0.040	*****	*****	31.47	31.70	0.053	0.047
1330	180.	0.193	0.202	0.008	0.029	0.038	2.0	0.008	31.52	31.77	0.055	0.046
1400	210.	0.216	0.227	0.008	0.025	0.035	2.0	*****	31.56	31.87	0.073	0.042
1430	240.	0.237	0.246	0.008	0.024	0.032	1.9	0.010	31.60	32.02	0.083	0.042
1500	270.	0.252	0.264	0.008	0.023	0.031	1.9	*****	31.81	32.20	0.092	0.041
1530	300.	0.267	0.275	0.007	0.023	0.032	1.9	0.009	31.95	32.35	0.083	0.040
1600	330.	0.276	0.285	0.007	0.022	0.030	1.9	*****	31.48	32.07	0.090	0.038
1630	360.	0.285	0.296	0.007	0.023	0.030	1.9	0.009	0.204	32.16	0.088	0.040

***** NO DATA TAKEN DATA DISCARDED ? QUESTIONABLE DATA

OZONE	360.0	MIN TOTAL DOSAGE = 61.75 ppm-min
NO	360.0	MIN TOTAL DOSAGE = 4.40 ppm-min
NO ₂ -PAN	360.0	MIN TOTAL DOSAGE = 10.16 ppm-min
PAN	360.0	MIN TOTAL DOSAGE = 2.30 ppm-min
OZONE DOSAGE GT 0.10 = 31.15 ppm-min		
OZONE DOSAGE GT 0.08 = 36.69 ppm-min		
NO ₂ -PAN DOSAGE GT 0.25 = 0.0 ppm-min		

PLOT

SURROGATE RUN 52-G
GLASS CHAMBER
1974 APR 8

LIGHTS ON 1100, OFF 1700. INTENSITY = 70% OF MAXIMUM
INITIAL RH = 48% (30.64 DEG C) FINAL RH = 37% (32.81 DEG C)
WAST FACTOR 1.76, CO 10 PPM FULL SCALE, PAN CALIBR. 3
AT T = 0: SURROGATE HC = 1173 PPBC; TOTAL NON-METHANE HC = 1450 PPB;
METHANE = 2080 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PPM (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO / NO2	TOT N (PPM)
1100	0.	0.0	*****	0.310	0.034	0.340	3.8	0.0	0.143	32.35	30.64	0.0	0.343
1115	15.	0.0	*****	0.298	0.046	0.338	3.8	*****	*****	33.19	31.69	0.0	0.344
1130	30.	0.0	*****	0.274	0.071	0.340	3.8	*****	*****	31.56	31.44	0.0	0.335
1145	45.	0.001	*****	0.250	0.085	0.335	3.8	*****	*****	31.54	31.85	0.003	0.334
1200	60.	0.0	*****	0.224	0.109	0.334	3.7	0.0	0.113	31.85	32.35	0.0	0.326
1215	75.	0.002	*****	0.193	0.133	0.327	3.7	*****	*****	32.00	32.44	0.003	0.322
1230	90.	0.005	*****	0.169	0.152	0.321	3.7	*****	*****	32.02	32.34	0.006	0.312
1245	105.	0.009	0.033	0.145	0.166	0.311	3.7	*****	*****	32.03	32.35	0.008	0.312
1300	120.	0.011	0.037	0.132	0.178	0.310	3.6	0.040?	0.040?	32.14	32.40	0.011	0.302
1316	136.	0.015	0.044	0.110	0.191	0.300	3.6	*****	*****	32.17	32.50	0.009	0.298
1330	150.	0.020	0.049	0.097	0.199	0.298	3.6	*****	*****	32.23	32.63	0.010	0.298
1346	166.	0.026	0.067	0.082	0.205	0.287	3.6	*****	*****	32.33	32.78	0.010	0.288
1400	180.	0.035	0.072	0.070	0.212	0.282	3.6	0.002	0.094?	32.36	32.79	0.011	0.283
1429	197.	0.049	0.088	0.054	0.216	0.270	3.5	*****	*****	32.44	32.81	0.012	0.272
1500	240.	0.069	0.111	0.043	0.216	0.260	3.5	0.003	0.196	32.57	32.94	0.014	0.264
1530	270.	0.092	0.150	0.035	0.213	0.248	3.5	*****	*****	32.54	32.94	0.015	0.252
1600	300.	0.119	0.176	0.024	0.210	0.234	3.5	0.005	0.208	32.50	32.92	0.014	0.239
1630	330.	0.145	0.211	0.024	0.198	0.220	3.5	*****	*****	32.41	32.83	0.018	0.228
1700	360.	0.173	0.250	0.020	0.192	0.209	3.5	0.007	0.222	32.39	32.81	0.018	0.220

***** NO DATA TAKEN ---- DATA DISCARDED

? QUESTIONABLE DATA

OZONE 360.0 MIN TOTAL DOSAGE = 18.94 PPM-MIN
NO 360.0 MIN TOTAL DOSAGE = 39.22 PPM-MIN
NO2-PAN 360.0 MIN TOTAL DOSAGE = 62.58 PPM-MIN
PAN 360.0 MIN TOTAL DOSAGE = 0.82 PPM-MIN
OZONE DOSAGE GT 0.10 = 3.02 PPM-MIN
OZONE DOSAGE GT 0.08 = 4.87 PPM-MIN
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

PLOT

SURROGATE RUN 53-6
GLASS CHAMBER
1974 APR 10

LIGHTS ON 1200, OFF 1803 INTENSITY = 70% OF MAXIMUM
 INITIAL RH = 43% (31.53 DEG C) FINAL RH = 28% (32.37 DEG C)
 VASIT FACTOR 1.76, CO FACTOR 2.84/29, PAN CALIBR. 3
 AT T = 0: SURROGATE HC = 1176 PPBC; TOTAL NON-METHANE HC = 1348 PPBC;
 METHANE = 2080 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO ₂ -PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO / NO ₂	TOT N (PPM)
1200	0.	0.0	0.0	0.049	0.007	0.056	3.5	0.0	0.124	33.65	31.53	0.0
1215	15.	0.013	*****	0.023	0.031	0.054	3.5	*****	*****	34.74	32.55	0.010
1230	30.	0.055	0.056	0.013	0.035	0.048	3.5	*****	*****	33.23	32.51	0.021
1245	45.	0.130	0.137	0.010	0.011	0.043	3.5	*****	*****	32.92	32.52	0.033
1300	60.	0.156	0.165	0.010	0.028	0.038	3.4	0.007	0.152	32.75	32.52	0.047
1315	75.	0.176	0.190	0.008	0.027	0.036	3.4	*****	*****	32.74	32.56	0.046
1330	90.	0.193	0.208	0.008	0.025	0.033	3.4	*****	*****	32.81	32.70	0.054
1345	105.	0.207	0.220	0.008	0.023	0.031	3.4	*****	*****	32.63	32.68	0.043
1400	120.	0.232	0.246	0.008	0.021	0.029	3.3	0.011	0.182	32.44	32.51	0.077
1430	150.	0.249	0.266	0.008	0.020	0.029	3.3	*****	*****	32.37	32.47	0.041
1500	180.	0.277	0.282	0.008	0.019	0.027	3.3	0.012	0.213	32.42	32.50	0.103
1530	210.	0.277	0.296	0.007	0.019	0.027	3.3	*****	*****	32.45	32.53	0.114
1600	240.	0.287	0.297	0.007	0.019	0.026	3.2	0.012	0.218	32.08	32.25	0.106
1630	270.	0.295	0.320	0.007	0.020	0.027	3.2	*****	*****	32.21	32.24	0.110
1700	300.	0.301	0.317	0.007	0.018	0.027	3.2	0.012	0.244	32.32	32.38	0.040
1730	330.	0.305	0.319	0.007	0.019	0.026	3.2	*****	*****	32.37	32.40	0.037
1800	360.							0.011	0.242	32.37	32.40	0.115

***** NO DATA TAKEN ? DATA DISCARDED ? QUESTIONABLE DATA

PLOT

DZONE 360.0 MIN TOTAL DOSAGE = 78.77 PPM-MIN
 NC 360.0 MIN TOTAL DOSAGE = 3.53 PPM-MIN
 NO₂-PAN 360.0 MIN TOTAL DOSAGE = 8.07 PPM-MIN
 PAN 360.0 MIN TOTAL DOSAGE = 3.60 PPM-MIN
 OZONE DOSAGE GT 0.10 = 45.55 PPM-MIN
 OZONE DOSAGE GT 0.08 = 51.95 PPM-MIN
 NO₂-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 54-G
GLASS CHAMBER
1974 APR 11

LIGHTS ON 1115, OFF NOT RECORDED INTENSITY = 70% OF MAXIMUM
 INITIAL RH = 46% (31.47 DEG C) FINAL RH = 28% (31.58 DEG C)
 WAST FACTOR 1.76, CO FACTOR 2.84/27.3, PAN CALIBR. 3
 AT T = 0: SURROGATE HC = 2154 PPBC; TOTAL NON-METHANE HC = 2380 PPBC;
 METHANE = 2830 PPB

CLOCK TIME	ELAPSED TIME (MIN)	DZONE (PPM)	OXIDANT (PPM)	NJ (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	O3*NO /NO2	TOT N (PPM)
1115	0.	0.0	0.047	0.008	0.055	7.4	0.0	0.071	33.74	31.47		0.0	0.055
1130	15.	0.015	0.016	0.020	0.030	0.052	7.4	*****	32.34	31.37		0.010	0.053
1145	30.	0.072	0.070	0.013	0.033	0.046	7.4	*****	31.94	31.62		0.029	0.050
1200	45.	0.118	0.113	0.012	0.029	0.040	7.4	*****	31.52	31.57		0.048	0.046
1215	60.	0.147	0.143	0.011	0.026	0.037	7.3	0.009	0.12	31.64		0.061	0.046
1230	75.	0.167	0.162	0.011	0.025	0.034	7.3	*****	31.41	31.55		0.073	0.046
1245	90.	0.183	0.180	0.010	0.022	0.032	7.2	*****	31.28	31.31		0.079	0.043
1300	105.	0.198	0.192	0.010	0.021	0.031	7.2	*****	31.22	31.36		0.091	0.043
1315	120.	0.209	0.204	0.010	0.018	0.028	7.2	0.014	0.156	31.29		0.109	0.042
1345	150.	0.226	0.222	0.010	0.018	0.028	7.1	*****	31.40	31.61		0.120	0.042
1415	180.	0.241	0.245	0.010	0.017	0.026	7.0	0.015	0.179	31.55		0.140	0.041
1445	210.	0.253	0.248	0.008	0.016	0.025	7.0	*****	31.50	31.65		0.129	0.040
1515	240.	0.267	0.257	0.008	0.016	0.026	6.9	0.015	0.186	31.58		0.138	0.040
1545	270.	0.272	0.287	0.008	0.018	0.026	6.8	*****	31.68	31.75		0.128	0.041
1615	300.	0.278	0.271	0.008	0.017	0.025	6.8	0.014	0.195	31.70		0.137	0.040
1645	330.	0.282	0.278	0.008	0.017	0.026	6.7	*****	31.62	31.60		0.137	0.040
1715	360.	0.289	0.278	0.008	0.018	0.026	6.6	0.014	0.196	31.59		0.137	0.040

***** NO DATA TAKEN

? QUESTIONABLE DATA

PLOT

OZONE	360.0	MIN TOTAL USAGE	77.11 PPM-MIN
NJ	360.0	MIN TOTAL USAGE	3.62 PPM-MIN
NO2-PAN	360.0	MIN TOTAL USAGE	7.13 PPM-MIN
PAN	360.0	MIN TOTAL USAGE	4.39 PPM-MIN
OZONE DOSAGE GT 0.10			43.55 PPM-MIN
OZONE DOSAGE GT 0.08			50.00 PPM-MIN
NO2-PAN DOSAGE GT 0.25			0.0 PPM-MIN

SURROGATE RUN 55-G
GLASS CHAMBER
1974 APR 15

LIGHTS ON 1045, OFF 2004 INTENSITY = 70% OF MAXIMUM

INITIAL RH = 44% (31.58 DEG C) FINAL RH = 27% (31.98 DEG C)

6 HOUR RH = 27% (32.28 DEG C)

WAST FACTOR 1.6; CO FACTOR 2.84/30.6; PAN CALIBR. 3

AT T = 0: SURROGATE HC = 1145 PPBC; TOTAL NON-METHANE HC = 1357 PPBC;

METHANE = 2080 PPB

OZONE OXIDANT NO NO2-PAN NOX-PAN CO PAN HCHO

CLOCK TIME (MIN) (PPM) (PPM) (PPM) (PPM) (PPM) (PPM) (PPM)

TIME (MIN) (PPM) (PPM) (PPM) (PPM) (PPM) (PPM) (PPM)

NO2-PAN NOX-PAN CO PAN HCHO

(PPM) (PPM) (PPM) (PPM) (PPM)

NO2/NO TOI N

(PPM) (PPM)

03*NO2

0.017

0.0

0.017

0.0

0.008

0.018

0.017

0.019

0.027

0.019

0.035

0.050

0.019

0.045

0.055

0.022

0.020

0.064

0.022

0.068

0.023

0.083

0.022

0.089

0.023

0.081

0.023

0.082

0.024

0.103

0.023

0.103

0.024

0.193

0.025

0.098

0.025

0.025

0.114

0.026

0.105

0.025

0.101

0.026

***** NO DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

OZONE 350.0 MIN TOTAL DOSAGE = 21.10 PPM-MIN
NO 360.0 MIN TOTAL DOSAGE = 3.91 PPM-MIN
NO2-PAN 360.0 MIN TOTAL DOSAGE = 3.16 PPM-MIN
PAN 360.0 MIN TOTAL DOSAGE = 0.55 PPM-MIN
OZONE 540.0 MIN TOTAL DOSAGE = 47.86 PPM-MIN
OZONE DOSAGE GT 0.10 = 0.60 PP4-MIN
OZONE DOSAGE GT 0.08 = 2.49 PPM-MIN
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

PLOT

SURROGATE RUN 56-G
GLASS CHAMBER
1974 APR 16

LIGHTS ON 1000, OFF 1116 INTENSITY = 70% OF MAXIMUM
INITIAL RH = 4.9% (31.84 DEG C) FINAL RH NOT RECORDED
MAST FACTOR 1.6, CO FACTOR 2.84/28.0, PAN CALIBR. 3
AT T = 0: SURROGATE HC = 1928 PPBC; TOTAL NON-METHANE HC = 2086 PPBC;

METHANE = 2100 PPB

CLOCK TIME (MIN)	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T SAMPLE T (DEG C)	03*NO /NO2	TOT N (PPM)
1000	0.	0.0	0.0	0.008	0.033	0.046	7.7	0.0	33.91	31.82	0.0
1015	15.	0.015	0.010	0.019	0.024	0.044	7.7	*****	32.60	31.62	0.012
1030	30.	0.069	0.062	0.012	0.027	0.039	7.7	*****	32.19	31.73	0.030
1045	45.	0.104	0.099	0.011	0.024	0.035	7.7	*****	31.94	31.78	0.043
1100	60.	0.128	0.125	0.011	0.021	0.033	7.7	0.008	31.94	31.81	0.047
1115	75.	0.147	0.141	0.011	0.021	0.031	7.7	*****	31.88	31.94	0.041
											0.067
											0.040
											0.040
											0.017
											0.040

***** NO DATA TAKEN

DATA DISCARDED ? QUESTIONABLE DATA

OZONE DOSAGE GT 0.10 =	0.83 PPM-MIN
OZONE DOSAGE GT 0.08 =	1.58 PPM-MIN
NO2-PAN DOSAGE GT 0.25 =	0.0 PPM-MIN

SURROGATE RUN 57-G
GLASS CHAMBER
1974 APR 16

LIGHTS ON 1515, OFF 1648 INTENSITY = 70% OF MAXIMUM
INITIAL RH = 50% (32.20 DEG C) FINAL RH = 47% (31.87 DEG C)
WAST FACTOR 1.6, CO FACTOR 2.84/28.0, PAN CALIBR. 3
AT T = 0: SURROGATE HC = 1912 PPBC; TOTAL NON-METHANE HC = 2147 PPBC;
METHANE = 2080 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO ₂ -PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	O ₃ *NO / NO ₂	TOT N (PPM)
1515	0.	0.0	0.0	0.030	0.014	0.044	7.4	0.0	31.91	31.14	0.0	0.04*
1530	15.	0.034	0.032	0.016	0.026	0.042	7.4	*****	32.12	31.79	0.021	0.043
1545	30.	0.079	0.074	0.014	0.023	0.038	7.3	*****	31.78	31.88	0.048	0.042
1600	45.	0.107	0.101	0.014	0.020	0.035	7.3	*****	31.50	31.85	0.076	0.041
1615	60.	0.127	0.118	0.014	0.018	0.033	7.3	0.003	31.83	31.84	0.101	0.041
1630	75.	0.142	0.134	0.014	0.017	0.031	7.2	*****	31.86	31.84	0.120	0.040
1645	90.	0.152	0.146	0.013	0.017	0.031	7.2	*****	31.90	31.88	0.118	0.038

***** NO DATA TAKEN DATA DISCARDED ? QUESTIONABLE DATA

OZONE DOSAGE GT 0.10 = 1.53 PPB-MIN
OZCNE DOSAGE GT 0.08 = 2.58 PPB-MIN
NO₂-PAN DOSAGE GT 0.25 = 0.0 PPB-MIN

SURROGATE RUN 58-G
GLASS CHAMBER
1974 APR 17

LIGHTS ON 1030, OFF 1149, INTENSITY = 70% OF MAXIMUM
INITIAL PH = 5.2% 131.39 DEG C, FINAL RH = 42% (31.36 DEG C)
MAST FACTOR 1.6, CO FACTOR 2.84/28.4, PAN CALIBR. 3
AT T = 0: SURROGATE HC = 1902 PPBC; TOTAL NON-METHANE HC = 2169 PPBC;
METHANE = 2860 PPB

CLOCK TIME (MIN)	ELAPSED OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NO-X-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	WALL T SAMPLE T (DEG C)	03*NO /NO2	TOT N (PPM)
1030	0.	0.0	0.029	0.010	0.038	7.3	0.0	0.083	32.20	31.32	0.0	0.038
1045	15.	0.027	*****	0.016	0.021	0.037	7.3	*****	32.70	32.10	0.020	0.038
1100	30.	0.067	0.369	0.014	0.018	0.033	*****	*****	31.76	31.78	0.052	0.036
1115	45.	0.091	0.099	0.014	0.017	0.031	7.3	*****	31.44	31.61	0.078	0.036
1130	60.	0.139	0.117	0.013	0.015	0.028	7.2	0.006	31.30	31.46	0.095	0.035
1145	75.	0.123	0.126	0.013	0.015	0.028	7.2	*****	31.19	31.36	0.107	0.035

***** NO DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

OZONE DOSAGE GT 0.10 =	0.31 PP-MIN
OZONE DOSAGE GT 0.08 =	0.92 PP-MIN
NO2-PAN DOSAGE GT 0.25 =	0.0 PP-MIN

SURROGATE RUN 59-G
GLASS CHAMBER
1974 APR 17

LIGHTS ON 1530, OFF NOT RECORDED INTENSITY = 70% OF MAXIMUM
 INITIAL RH = 50% (31.69 DEG C) FINAL RH = 40% (31.92 DEG C)
 MAST FACTOR 1.6, CO FACTOR 2.84/28.4, PAN CALIBR. 3
 AT T = 0: SURROGATE HC = 1894 PPBCC; TOTAL NON-METHANE HC = 2174 PPB;
 METHANE = 2820 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	N2 (PPM)	NO2-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	D3*NO /NO2	TOT N (PPM)
1530	0.	0.0	0.0	0.008	0.0032	6.6	0.0	0.075	32.49	31.93	0.0	0.032
1545	15.	0.027	0.021	0.016	0.014	0.030	6.6	*****	32.73	32.13	0.029	0.031
1600	30.	0.053	0.045	0.014	0.014	0.029	6.6	*****	32.24	32.12	0.054	0.031
1615	45.	0.073	0.064	0.014	0.013	0.027	6.5	*****	32.03	32.02	0.082	0.031
1630	60.	0.085	0.069	0.013	0.013	0.026	6.5	0.005	0.141	31.96	0.088	0.031
1645	75.	0.096	0.078	0.013	0.012	0.025	6.4	*****	31.95	31.92	0.110	0.030
1700	90.	0.103	0.083	0.013	0.010	0.024	6.4	*****	31.93	31.92	0.131	0.029

***** NO DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

OZONE DOSAGE GT 0.10	= 0.02 PPM-MIN
OZONE DOSAGE GT 0.08	= 0.49 PPM-MIN
NO2-PAN DOSAGE GT 0.25	= 0.0 PPM-MIN

SURROGATE RUN 60-G
GLASS CHAMBER
1974 APR 16

LIGHTS ON 1045, OFF 1247 INTENSITY = 70% OF MAXIMUM
INITIAL RH = 50% (31.93 DEG C) FINAL RH = 37% (31.53 DEG C)
MAST FACTOR 1.6, CJ FACTOR 2.84/28.4, PAN CALIBR. 3
AT T = 0: SURROGATE HC = 501 PPBC; TOTAL NON-METHANE HC = 618 PPBC;
METHANE = 1730 PPB

CLOCK	ELAPSED TIME (HRS)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO /NO2	TOT N (PPM)
1045	0.	0.0	0.0	0.038	0.007	0.046	1.6	0.0	0.051	32.04	32.12	0.3	0.046
1100	15.	3.004	0.006	0.029	0.016	0.045	1.6	*****	*****	32.91	32.04	0.007	0.046
1115	30.	0.018	0.019	0.019	0.023	0.043	1.6	*****	*****	31.67	31.63	0.015	0.043
1130	45.	0.038	0.037	0.016	0.025	0.041	1.6	*****	*****	31.27	31.44	0.023	0.042
1145	60.	0.057	0.053	0.013	0.026	0.039	1.6	0.001	0.102	31.16	31.36	0.029	0.041
1200	75.	0.074	0.069	0.013	0.025	0.038	1.6	*****	*****	31.17	31.34	0.039	0.040
1215	90.	0.092	0.083	0.012	0.025	0.037	1.6	*****	*****	31.22	31.57	0.044	0.038
1230	105.	0.109	0.098	0.012	0.025	0.037	1.6	*****	*****	31.33	31.56	0.052	0.038
1245	120.	0.124	0.112	0.011	0.025	0.036	1.6	*****	*****	31.53	31.53	0.054	0.037

***** NG DATA TAKEN ----- DATA DISCARDED ? QUESTIONABLE DATA

OZONE DOSAGE GT 0.10 = 0.31 PPM-MIN
OZONE DOSAGE GT 0.08 = 0.94 PPM-MIN
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 61-G
GLASS CHAMBER
1974 APR 16

LIGHTS ON 1600, OFF 1745 INTENSITY = 70% OF MAXIMUM
INITIAL RH = 52% (33.18 DEG C) FINAL RH NOT RECORDED
CJ FACTOR 1.6, CJ FACTOR 2*84/28*.4, PAN CALIBR. 3
AT T = 0: SURROGATE HC = 504 PPB; TOTAL NON-METHANE HC = 740 PPB;
METHANE = 1730 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO ₂ -PAN (PPM)	NO _x -PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03+NO ₂ /NO ₂	TOT N (PPM)
1600	0.	0.0	0.0	0.049	0.008	0.059	2.4	0.0	0.078	31.98	33.46	0.0	0.058
1615	15.	0.004	0.005	0.037	0.019	0.057	2.4	0.0	*****	32.88	32.09	0.008	0.056
1630	30.	0.021	0.026	0.028	0.027	0.055	2.4	0.0	*****	31.90	31.75	0.021	0.055
1645	45.	0.041	0.045	0.023	0.029	0.052	2.4	0.0	*****	31.49	31.64	0.032	0.053
1700	60.	0.057	0.057	0.020	0.030	0.051	2.4	0.0	*****	31.37	31.58	0.039	0.052
1715	75.	0.076	0.075	0.019	0.030	0.049	2.3	0.0	0.137	31.32	31.43	0.049	0.050
1730	90.	0.094	0.093	0.018	0.029	0.048	2.3	0.0	*****	31.19	31.52	0.059	0.048
1745	105.	0.112	0.102	0.018	0.029	0.047	2.3	0.0	*****	31.25	31.47	0.070	0.048

***** NJ DATA TAKEN

---- DATA DISCARDED

? QUESTIONABLE DATA

OZONE DOSAGE GT 0-10 = 0.09 PPM-MIN
OZONE DOSAGE GT 0-08 = 0.45 PPM-MIN
NO₂-PAN DOSAGE GT 0-25 = 0.0 PPM-MIN

SURROGATE RUN 62-G
GLASS CHAMBER
1974 APR 22

LIGHTS ON 1115, OFF 1952 INTENSITY = 70% OF MAXIMUM
INITIAL RH = 50% (32.73 DEG C) FINAL RH = 34% (31.57 DEG C)
6 HOUR RH = 34% (32.04 DEG C)
MAST FACTOR 1.6, CJ 10 PPB FULL SCALE, PAN CALIBR. 3
AT T = 0: SURROGATE HC = 498 PPBC; TOTAL NON-METHANE HC = 746 PPB;
METHANE = 1700 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	D3*ND /NO2	TOT N (PPM)
1115	0.	0.0	0.0	0.071	0.025	0.096	2.1	0.0	0.069	0.0
1130	15.	0.004	0.003	0.060	0.036	0.096	2.0	*****	0.007	0.096
1145	30.	0.009	0.011	0.043	0.048	0.092	2.0	*****	0.008	0.091
1200	45.	0.019	0.021	0.038	0.052	0.091	2.0	*****	0.014	0.091
1215	60.	0.034	0.035	0.031	0.057	0.088	2.0	0.001	0.019	0.059
1230	75.	0.047	0.042	0.028	0.057	0.084	2.0	*****	0.023	0.085
1245	90.	0.066	0.053	0.024	0.056	0.080	2.0	*****	0.028	0.082
1300	105.	0.081	0.066	0.022	0.056	0.077	2.0	*****	0.031	0.079
1315	120.	0.095	0.074	0.022	0.054	0.075	2.0	*****	0.038	0.078
1345	150.	0.123	0.098	0.019	0.051	0.071	2.0	0.003	0.046	0.073
1400	165.	0.140	0.114	0.018	0.049	0.066	2.0	*****	0.051	0.071
1415	180.	0.155	0.128	0.017	0.046	0.064	2.0	0.004	0.057	0.067
1446	211.	0.188	0.144	0.016	0.043	0.059	2.0	*****	0.069	0.064
1515	240.	0.216	0.178	0.019	0.039	0.054	2.0	0.006	0.079	0.060
1545	270.	0.239	0.186	0.014	0.036	0.050	2.0	*****	0.095	0.058
1615	300.	0.261	0.224	0.014	0.033	0.048	2.0	0.007	0.112	0.055
1645	330.	0.281	0.240	0.013	0.032	0.045	2.0	*****	0.116	0.053
1717	362.	0.298	0.278	0.012	0.030	0.041	2.0	0.008	0.119	0.050
1745	390.	0.308	0.301	0.012	0.029	0.040	2.1	*****	0.127	0.049
1815	420.	0.319	0.328	0.013	0.026	0.038	2.1	*****	0.165	0.047
1946	511.	0.343	0.333	0.010	0.026	0.035	2.1	0.008	0.127	0.043
2015	540.	0.351	*****	*****	*****	*****	*****	*****	0.351	*****

***** NO DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

***** NO DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

PLOT

OZCNE	362.0	MIN TOTAL DOSAGE = 54.96 PPM-MIN
NJ	362.0	MIN TOTAL DOSAGE = 8.15 PPM-MIN
NO2-PAN	362.0	MIN TOTAL DOSAGE = 15.77 PPM-MIN
PAN	362.0	MIN TOTAL DOSAGE = 1.51 PPM-MIN
OZONE	0.0	MIN TOTAL DOSAGE = 114.92 PPM-MIN
OZONE	0.0	DOSAGE GT 0.10 = 26.22 PPM-MIN
OZONE	0.0	DOSAGE GT 0.08 = 31.12 PPM-MIN
NO2-PAN	0.0	DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 63-G
GLASS CHAMBER
1974 APR 23

LIGHTS ON 1015, OFF 1132 INTENSITY = 70% OF MAXIMUM
INITIAL RH = 52% (31.62 DEG C) FINAL RH 46% (32.18 DEG C)
MAST FACTOR 1.6* CO FACTOR 2.84/28*⁴, PAN CALIBR.³
AT T = 0: SURROGATE HC = 2401 PPBC; TOTAL NON-METHANE HC = 2625 PPBC;
METHANE = 2670 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	O3+NO /NO2	TOT N (PPM)
1015	0.	0.0	0.0	0.016	0.042	0.016	0.058	7.2	0.0	34.08	31.89	0.0	0.058
1030	15.	0.030	0.037	0.022	0.037	0.022	0.054	7.2	*****	32.10	31.32	0.020	0.055
1045	30.	0.084	0.090	0.017	0.017	0.017	0.049	7.2	*****	30.93	31.00	0.044	0.053
1100	45.	0.127	0.130	0.017	0.017	0.028	0.045	7.2	*****	31.49	31.70	0.077	0.050
1115	60.	0.150	0.157	0.016	0.025	0.016	0.041	7.2	0.008	31.97	32.36	0.095	0.048
1130	75.	0.166	0.173	0.016	0.023	0.016	0.040	7.1	*****	31.84	32.18	0.111	0.047

***** NO DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

OZONE DOSAGE GT 0.10 = 1.65 PPM-MIN
OZONE DOSAGE GT 0.08 = 2.46 PPM-MIN
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 64-6
GLASS CHAMBER
1974 APR 23

LIGHTS ON 1600, OFF 1732 INTENSITY = 70% OF MAXIMUM
 INITIAL RH = 57% (32.00 DEG C) FINAL RH 51% (32.10 DEG C)
 WAST FACTOR 1.6, CO FACTOR 2.84/28.4, PAN CALIBR. 3
 AT T = 0: SURROGATE HC = 1181 PPBC; TOTAL NON-METHANE HC = 1330 PPBC;
 METHANE = 2100 PPB

CLOCK TIME (MIN)	ELAPSED TIME (MIN)	JZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	TOT N (PPM)		
											03*NO /NO2	TOT N (PPM)	
1600	0.	0.0	0.0	0.080	0.016	0.096	3.7	0.0	0.051	33.18	31.60	0.0	0.096
1615	15.	0.006	0.011	0.064	0.030	0.095	3.8	*****	*****	32.70	31.97	0.013	0.095
1630	30.	0.022	0.034	0.038	0.051	0.069	3.7	*****	*****	33.32	33.05	0.017	0.091
1645	45.	0.050	0.059	0.030	0.057	0.087	3.7	*****	*****	32.58	32.69	0.026	0.090
1700	60.	0.083	0.091	0.026	0.054	0.081	3.7	0.003	*****	32.07	32.34	0.040	0.084
1715	75.	0.111	0.120	0.024	0.054	0.078	3.7	0.43	*****	31.88	32.18	0.049	0.082
1730	90.	0.144	0.139	0.022	0.053	0.075	3.7	*****	*****	31.77	32.10	0.057	0.078

***** NJ DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

OZONE DOSAGE GT 0.10 = 0.46 PPM-MIN
 OZONE DOSAGE GT 0.08 = 0.95 PPM-MIN
 NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 65-G
GLASS CHAMBER
1974 APR 24

LIGHTS ON 1030, OFF 1147. INTENSITY = 70% OF MAXIMUM
INITIAL RH = 50% (31.56 DEG C)
WAST FACTOR 1.6, CO FACTOR 2.84/28.4, PAN CALIBR. 3
AT T = 0: SURROGATE HC = 1064 PPBC; TOTAL NON-METHANE HC = 1152 PPBC;
METHANE = 496 PPB, ETHANE (ADDED INSTEAD OF METHANE) = ABOUT 1600 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO ₂ -PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO ₂ /NO	TOT N (PPM)
1030	0.	0.0	0.0	0.028	0.010	0.037	0.0	3.7	31.65	33.78	0.0	0.037
1045	15.	0.021	0.024	0.018	0.017	0.035	3.7	3.7	32.04	33.08	0.022	0.036
1100	30.	0.055	0.059	0.016	0.019	0.033	3.7	3.7	32.40	32.20	0.046	0.036
1115	45.	0.079	0.085	0.014	0.018	0.032	3.7	3.7	31.63	31.82	0.064	0.035
1130	60.	0.098	0.104	0.014	0.016	0.030	3.7	0.004	31.37	31.68	0.091	0.034
1145	75.	0.113	0.122	0.013	0.016	0.029	3.6	3.6	31.27	31.62	0.096	0.032

***** NO DATA TAKEN ----- DATA DISCARDED ----- ? QUESTIONABLE DATA

OZONE DOSAGE GT 0-10 = 0.10 PPM-MIN
OZONE DOSAGE GT 0-08 = 0.52 PPM-MIN
NO₂-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 66-G
GLASS CHAMBER
1974 APR 24

LIGHTS ON 1515, OFF 1719, INTENSITY = 70% OF MAXIMUM
INITIAL RH = 50% 130.95 DEG C, FINAL RH 43% (32.00 DEG C)
MAST FACTOR 1.6, CO FACTOR 2.84/28.4, PAN CALIBR. 3
AT T = 0; SURROGATE HC = 488 PPBC; TOTAL NON-METHANE HC = 759 PPBC;
METHANE = 1700 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO /NO2	TOT N (PPM)
1515	0.	0.0	0.0	0.029	0.008	0.038	1.8	0.0	0.217	32.84	31.37	0.0 0.037
1530	15.	0.013	0.016	0.023	0.014	0.037	1.8	*****	*****	32.30	31.65	0.021 0.037
1545	30.	0.034	0.038	0.019	0.016	0.035	1.8	*****	*****	32.27	31.18	0.041 0.036
1600	45.	0.054	0.061	0.018	0.016	0.034	1.8	*****	*****	31.67	31.82	0.059 0.036
1615	60.	0.071	0.077	0.017	0.016	0.033	1.8	0.002	-----	31.55	31.86	0.075 0.035
1630	75.	0.085	0.110	0.017	0.016	0.031	1.8	*****	*****	31.54	31.87	0.091 0.035
1645	90.	0.098	0.106	0.016	0.015	0.031	1.8	*****	*****	31.57	31.91	0.099 0.034
1701	106.	0.109	0.117	0.016	0.015	0.031	1.8	*****	*****	31.63	31.96	0.112 0.034
1715	120.	0.118	0.128	0.016	0.014	0.029	1.8	0.003	*****	31.66	32.00	0.133 0.032

***** NO DATA TAKEN ----- DATA DISCARDED ? QUESTIONABLE DATA

OZONE DOSAGE GT 0.10 = 0.26 PPM-MIN
OZONE DOSAGE GT 0.08 = 1.05 PPM-MIN
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 67-G
GLASS CHAMBER
1974 APR 25

LIGHTS ON 1000, OFF 1216. INTENSITY = 70% OF MAXIMUM
INITIAL RH = 50% 130.95 DEG C) FINAL RH 39% (31.40 DEG C)
WAST FACTOR 1.6 CO FACTOR 2.84/28.4, PAN CALIBR. 3
AT T = 0: SURROGATE HC = 1161 PPBC; TOTAL NON-METHANE HC = 1274 PPBC;
METHANE = 2020 PPB

CLOCK TIME	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO ₂ -PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO /NO ₂		TOT N (PPM)		
											NO ₂ -PAN	PAN	HCHO	WALL T	SAMPLE T
1000	0.	0.0	0.0	0.022	0.007	0.030	0.0	3.9	32.51	30.86	0.0	0.0	0.029	0.022	0.030
1015	15.	0.014	0.018	0.018	0.011	0.029	0.0	3.9	32.12	31.42	0.054	0.054	0.022	0.022	0.030
1030	30.	0.039	0.042	0.016	0.016	0.029	0.0	3.9	32.74	32.45	0.055	0.055	0.045	0.045	0.030
1045	45.	0.061	0.055	0.061	0.012	0.027	0.0	3.9	33.51	33.36	0.055	0.055	0.074	0.074	0.029
1100	60.	0.069	0.072	0.016	0.011	0.027	0.0	3.9	32.77	32.88	0.073	0.073	0.097	0.097	0.029
1115	75.	0.078	0.083	0.014	0.012	0.027	0.0	3.8	32.13	32.38	0.074	0.074	0.093	0.093	0.029
1130	90.	0.088	0.096	0.016	0.011	0.026	0.0	3.8	31.75	32.02	0.075	0.075	0.128	0.128	0.029
1145	105.	0.095	0.102	0.014	0.012	0.026	0.0	3.8	31.54	31.78	0.076	0.076	0.117	0.117	0.029
1200	120.	0.102	0.112	0.014	0.011	0.026	0.0	3.7	31.55	31.33	0.003	0.003	0.129	0.129	0.029

***** NO DATA TAKEN ----- DATA DISCARDED ----- QUESTIONABLE DATA

OZONE DOSAGE GT 0.10 = 0.02 PPM-MIN
OZONE DOSAGE GT 0.08 = 0.51 PPM-MIN
NO₂-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 68-G
GLASS CHAMBER
1974 APR 25

LIGHTS ON 1545, OFF NOT RECORDED INTENSITY = 70% OF MAXIMUM
INITIAL RH 51% (31.62 DEG C) FINAL RH 39% (31.40 DEG C)
WAST FACTOR 1.6, CO FACTOR 2.84/28.4, PAN CALIBR. 3
AT T = 0: SURROGATE HC = 513 PPBC; TOTAL NON-METHANE HC = 623 PPBC;
METHANE = 1700 PPB

CLOCK TIME (MIN)	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	C ₂ (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO _x / NO ₂ (PPM)	TOT N (PPM)
1545	0.	0.0	0.0	0.023	0.007	0.031	1.8	0.0	0.051	31.38	31.62	0.0	0.030
1600	15.	0.014	0.018	0.020	0.009	0.030	1.8	*****	*****	33.15	32.16	0.031	0.030
1615	30.	0.032	0.037	0.019	0.010	0.029	1.9	*****	*****	33.38	33.08	0.060	0.030
1630	45.	0.046	0.053	0.019	0.010	0.029	1.8	*****	*****	32.56	32.68	0.089	0.030
1645	60.	0.057	0.064	0.018	0.011	0.029	1.8	0.001	0.095	32.10	32.36	0.094	0.030
1700	75.	0.067	0.074	0.017	0.011	0.029	1.6	*****	*****	31.92	*****	0.105	0.029
1715	90.	0.077	0.083	0.017	0.011	0.027	1.3	*****	*****	31.85	32.15	0.123	0.029
1730	105.	0.086	0.098	0.017	0.012	0.028	1.8	*****	*****	31.60	32.09	0.125	0.030
1745	120.	0.093	0.131	0.017	0.011	0.027	1.8	0.002	0.136	31.74	32.04	0.137	0.030
1600	135.	0.100	0.112	0.017	0.010	0.027	1.8	*****	*****	31.71	32.04	0.164	0.029

***** NO DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

OZONE DOSAGE GT 0.10 = 0.0 PPM-MIN
OZONE DOSAGE GT 0.08 = 0.43 PPM-MIN
NO₂-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 69-G
GLASS CHAMBER
1974 APR 26

LIGHTS ON 1015, OFF 1628 INTENSITY = 70% OF MAXIMUM
INITIAL RH = 50% (30.03 DEG C) FINAL RH = 39% (31.10 DEG C)
MAST FACTOR 1.6, CO 10 PPM FULL SCALE, PAN CALIBR. 3
AT T = 0: SURROGATE HC = 328 PPBC; TOTAL NON-METHANE HC = 554 PPBC;
METHANE = 1520 PPM

CLOCK TIME	ELAPSED TIME(MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO /NO2	TOT N (PPM)
1015	0.	0.0	0.0	0.024	0.007	0.031	1.2	0-0	0.078	32.27	30.03	0.0	0.031
1030	15.	0.007	0.008	0.020	0.011	0.031	1.2	*****	*****	34.30	32.32	0.014	0.031
1045	30.	0.021	0.021	0.017	0.014	0.031	1.2	*****	*****	35.30	33.32	0.025	0.031
1100	45.	0.036	0.042	0.016	0.014	0.029	1.2	*****	*****	32.38	32.06	0.041	0.030
1115	60.	0.049	0.051	0.015	0.014	0.029	1.2	0-0.001	0-0.064	31.54	31.51	0.048	0.030
1130	75.	0.062	0.064	0.014	0.013	0.028	1.2	*****	*****	31.24	31.13	0.067	0.029
1145	90.	0.072	0.078	0.013	0.013	0.026	1.2	*****	*****	31.08	30.93	0.073	0.028
1200	105.	0.083	0.090	0.013	0.013	0.026	1.2	*****	*****	30.83	31.00	0.086	0.028
1215	120.	0.090	0.096	0.014	0.014	0.027	1.2	0.002	0.095	30.77	30.95	0.086	0.029
1245	150.	0.107	0.114	0.013	0.012	0.025	1.2	*****	*****	30.72	30.91	0.115	0.028
1315	180.	0.122	0.128	0.012	0.012	0.025	1.2	0.003	0.126	30.86	30.69	0.123	0.026
1345	210.	0.133	0.144	0.012	0.013	0.026	1.2	*****	*****	30.80	30.94	0.122	0.026
1415	240.	0.143	0.154	0.012	0.013	0.025	1.2	0.003	0.140	30.83	30.95	0.131	0.028
1445	270.	0.152	0.152	0.012	0.013	0.024	1.2	*****	*****	30.83	30.98	0.141	0.026
1515	300.	0.161	0.165	0.012	0.012	0.024	1.2	0.003	0.155	30.94	31.04	0.166	0.026
1545	330.	0.168	0.166	0.011	0.013	0.024	1.2	*****	*****	30.98	31.07	0.140	0.026
1615	360.	0.176	0.181	0.010	0.013	0.023	1.2	0.003	0.159	31.01	31.11	0.129	0.025

***** NO DATA TAKEN

DATA DISCARDED

? QUESTIONABLE DATA

PLOT

OZONE	360.0	MIN TOTAL DOSAGE = 39.19 PPM-MIN
NJ	360.0	MIN TOTAL DOSAGE = 4.76 PPM-MIN
NO2-PAN	360.0	MIN TOTAL DOSAGE = 4.56 PPM-MIN
PAN	360.0	MIN TOTAL DOSAGE = 0.71 PPM-MIN
OZONE	DOSAGE GT 0.10 = 9.72 PPM-MIN	
OZONE	DOSAGE GT 0.08 = 14.49 PPM-MIN	
NO2-PAN	DOSAGE GT 0.25 = 0.0 PPM-MIN	

SURROGATE RUN 70-H
GLASS CHAMBER
1974 MAY 8

LIGHTS ON 1115, OFF NOT RECORDED INTENSITY 70% OF MAXIMUM
 INITIAL RH = 53% (31.64 DEG C) FINAL RH = 42% (31.25 DEG C)
 MAST FACTOR 1.6, CJ FACTOR 2.64/29.5, PAN CALIBR. 4
 SPECIAL AROMATICS SURROGATE: AT T = 0, TOTAL NON-METHANE HC = 2344 PPBC,
 METHANE = 2690 PPB

CLOCK TIME(MIN)	ELAPSED OZONE (PPM)	OXIDANT NO (PPM)	NO2-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T SAMPLE T (DEG C)	Q3*NO /NO2	TOT N (PPM)
1115	0.	0.0	0.277	0.044	0.8	0.0	33.41	31.62	0.0
1130	15.	0.0	0.251	0.072	0.321	6.8	*****	31.15	0.0
1145	30.	0.003	0.016	0.192	0.126	0.314	6.8	*****	0.319
1200	45.	0.006	0.030	0.144	0.165	0.306	6.8	*****	0.005
1215	60.	0.015	0.048	0.089	0.211	0.294	6.7	0.120	0.310
1230	75.	0.039	0.069	0.059	0.224	0.283	6.7	0.01	0.266
1245	90.	0.066	0.099	0.037	0.231	0.270	6.6	*****	0.011
1300	105.	0.097	0.128	0.030	0.226	0.258	6.6	*****	0.272
1315	120.	0.127	0.024	0.223	0.247	6.6	0.006	0.161	0.013
							31.20	31.25	0.262
									0.014
									0.253

* ***** NG DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

OZONE	120.0	MIN TOTAL DOSAGE	=	4.34 PPM-MIN
NO	120.0	MIN TOTAL DOSAGE	=	14.28 PPM-MIN
NO2-PAN	120.0	MIN TOTAL DOSAGE	=	20.84 PPM-MIN
PAN	120.0	MIN TOTAL DOSAGE	=	0.28 PPM-MIN
OZONE DOSAGE GT 0.10	=	0.20 PPM-MIN		
OZONE DOSAGE GT 0.08	=	0.61 PPM-MIN		
NO2-PAN DOSAGE GT 0.25	=	0.0 PPM-MIN		

SURROGATE RUN 71-H
GLASS CHAMBER
1974 MAY 10

LIGHTS ON 0945, OFF 1341, INTENSITY 70% OF MAXIMUM
INITIAL RH = 48% (31.70 DEG C) FINAL RH 35% (30.55 DEG C)
MAST FACTOR 1.6, CO FACTOR 2.84/28.4, PAN CALIBR. 4
SPECIAL AROMATICS SURROGATE: AT T = 0, TOTAL NON-METHANE HC = 2454 PPBC,
METHANE = 2680 PPB

CLOCK TIME	ELAPSED TIME(MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO /NO2	TOT N (PPM)
945	0.	0.0	0.008	0.270	0.043	0.313	7.1	0.0	0.084	34.61	31.84	0.0	0.313
1000	15.	0.0	0.913	0.247	0.068	0.312	7.0	*****	*****	32.85	31.78	0.0	0.316
1015	30.	0.0	0.013	0.203	0.109	0.311	7.0	*****	*****	32.59	32.20	0.0	0.312
1030	45.	0.003	0.032	0.149	0.158	0.302	7.0	0.000	*****	31.51	31.58	0.003	0.307
1045	60.	0.013	0.046	0.102	0.193	0.291	6.9	0.001	0.120	31.08	31.10	0.007	0.296
1100	75.	0.030	0.066	0.058	0.216	0.279	6.9	*****	*****	30.78	30.76	0.010	0.287
1115	90.	0.052	0.096	0.048	0.224	0.269	6.8	*****	*****	31.60	30.58	0.011	0.276
1130	105.	0.085	0.126	0.031	0.227	0.257	6.8	*****	*****	30.46	30.46	0.012	0.264
1145	120.	0.112	0.147	0.026	0.221	0.245	6.8	0.007	0.170	30.43	30.40	0.013	0.254
1200	135.	0.134	0.118	0.023	0.209	0.232	6.6	*****	*****	30.42	30.49	0.015	0.240
1215	150.	0.163	0.202	0.022	0.207	0.221	6.7	0.009	*****	30.46	30.55	0.017	0.238

***** NO DATA TAKEN ---- DATA DISCARDED ---- ? QUESTIONABLE DATA

OZCNE 150.0 MIN TOTAL DOSAGE = 7.66 PPM-MIN
NO 150.0 MIN TOTAL DOSAGE = 15.65 PPM-MIN
NO2-PAN 150.0 MIN TOTAL DOSAGE = 26.26 PPM-MIN
PAN 150.0 MIN TOTAL DOSAGE = 0.49 PPM-MIN
OZCNE DOSAGE GT 0.10 = 1.16 PPM-MIN
OZCNE DOSAGE GT 0.06 = 1.99 PPM-MIN
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

SURROGATE RUN 72-G
GLASS CHAMBER
1974 MAY 15

LIGHTS ON 1030, OFF NOT RECORDED INTENSITY = 70% OF MAXIMUM
 INITIAL RH = 51% (30.78 DEG C) FINAL RH = 34% (30.90 DEG C)
 WAST FACTOR 1.6, CO FACTOR 2.84/27.0, PAN CALIBR. 4
 AT T = 0: SURROGATE HC = 1161 PPBC; TOTAL NON-METHANE HC = 1301 PPBC;
 METHANE = 2100 ppb

CLOCK TIME	ELAPSED TIME(MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	NOX-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO /NO2	TOT N (PPM)
1030	0.	0.0	0.006	0.196	0.028	0.222	3.8	0.0	0.075	31.82	30.76	0.0	0.223
1045	15.	0.0	0.005	0.173	0.053	0.222	3.8	***	***	32.96	31.75	0.0	0.223
1100	30.	0.001	0.010	0.140	0.079	0.218	3.8	***	***	31.44	31.42	0.002	0.220
1115	45.	0.006	0.016	0.109	0.108	0.215	3.8	***	***	31.10	31.38	0.006	0.217
1130	60.	0.012	0.030	0.079	0.126	0.207	3.7	0.00	0.134	31.14	31.41	0.008	0.205
1145	75.	0.024	0.042	0.060	0.140	0.202	3.7	***	***	31.24	31.44	0.010	0.200
1200	90.	0.038	0.054	0.049	0.148	0.196	3.7	***	***	31.23	31.43	0.113	0.198
1215	105.	0.052	0.072	0.038	0.151	0.190	3.7	***	***	31.02	31.22	0.013	0.191
1230	120.	0.068	0.085	0.032	0.152	0.185	3.7	0.00	0.203	30.90	31.05	0.014	0.186
1300	150.	0.100	0.112	0.026	0.150	0.174	3.7	***	***	30.63	30.72	0.018	0.179
1330	180.	0.130	0.144	0.022	0.146	0.165	3.7	0.003	0.200	30.50	30.59	0.019	0.170
1400	210.	0.163	0.178	0.019	0.139	0.155	3.7	***	***	30.58	30.71	0.023	0.162
1430	240.	0.194	0.214	0.016	0.133	0.147	3.6	0.005	0.204	30.62	30.79	0.023	0.154
1500	270.	0.231	0.240	0.016	0.122	0.138	3.6	***	***	30.71	30.87	0.030	0.143
1530	300.	0.261	0.274	0.013	0.116	0.130	3.6	0.006	0.195	30.86	30.93	0.030	0.136
1600	330.	0.294	0.306	0.012	0.107	0.119	3.6	***	***	30.81	30.93	0.033	0.126
1630	360.	0.324	0.336	0.012	0.094	0.108	3.6	0.008	0.228	30.75	30.90	0.041	0.114

***** NJ DATA TAKEN ---- DATA DISCARDED ? QUESTIONABLE DATA

OZONE	360.0	MIN TOTAL DOSAGE = 49.57 PPM-MIN
HC	360.0	MIN TOTAL DOSAGE = 15.79 PPM-MIN
NO2-PAN	360.0	MIN TOTAL DOSAGE = 44.53 PPM-MIN
PAN	360.0	MIN TOTAL DOSAGE = 1.15 PPM-MIN
OZONE DOSAGE GT 0.10 = 23.55 PPM-MIN		
OZONE DOSAGE GT 0.08 = 28.05 PPM-MIN		
NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN		

PLOT

SURROGATE RUN 73-G
GLASS CHAMBER
1974 MAY 16

LIGHTS ON 1015, OFF 1620 INTENSITY = 70% OF MAXIMUM
 INITIAL RH = 51% (31.02 DEG C)
 FINAL RH = 32% (30.92 DEG C)
 MAST FACTOR 1.6, CO CALIBR. 2.84/26.7, PAN CALIBR. 4
 AT T = 0: SURROGATE HC = 358 PPBC; TOTAL NON-METHANE HC = 497 PPBC;
 METHANE = 1570 PPB

CLOCK	ELAPSED TIME (MIN)	OZONE (PPM)	OXIDANT (PPM)	NO (PPM)	NO2-PAN (PPM)	CO (PPM)	PAN (PPM)	HCHO (PPM)	WALL T (DEG C)	SAMPLE T (DEG C)	03*NO /NO2	TOT N (PPM)
1015	0.	0.0	0.0	0.080	0.020	0.101	1.2	0.0	0.066	32.18	31.02	0.0
1030	15.	0.0	0.003	0.070	0.029	0.101	1.2	*****	*****	33.16	31.88	0.0
1045	30.	0.004	0.006	0.058	0.041	0.098	*****	*****	*****	31.56	31.50	0.006
1100	45.	0.010	0.016	0.046	0.050	0.096	*****	*****	*****	31.13	31.30	0.008
1115	60.	0.017	0.021	0.038	0.055	0.093	1.2	0.000	0.103	31.02	31.20	0.012
1130	75.	0.027	0.034	0.031	0.060	0.091	*****	*****	*****	30.96	31.10	0.014
1145	90.	0.036	0.045	0.026	0.062	0.090	1.2	*****	*****	30.93	31.06	0.015
1200	105.	0.047	0.050	0.024	0.062	0.086	*****	*****	*****	30.92	31.06	0.018
1215	120.	0.058	0.061	0.023	0.062	0.085	1.2	0.001	0.137	30.92	31.06	0.026
1245	150.	0.081	0.082	0.019	0.062	0.081	1.2	*****	*****	30.95	31.08	0.025
1315	180.	0.105	0.102	0.017	0.061	0.077	1.2	0.001	0.145	31.00	31.12	0.029
1345	210.	0.131	0.128	0.014	0.056	0.073	*****	*****	*****	31.08	31.22	0.034
1415	240.	0.156	0.146	0.014	0.053	0.069	1.2	0.002	0.171	31.05	31.17	0.042
1445	270.	0.182	0.176	0.016	0.051	0.066	1.2	*****	*****	31.09	31.06	0.056
1515	300.	0.206	0.205	0.013	0.048	0.061	1.2	0.002	0.176	30.96	30.97	0.057
1545	330.	0.228	0.237	0.012	0.045	0.057	1.3	*****	*****	30.88	30.92	0.060
1615	360.	0.249	0.266	0.012	0.044	0.055	1.3	0.003	*****	30.90	30.92	0.068

***** NG DATA TAKEN

---- DATA DISCARDED

? QUESTIONABLE DATA

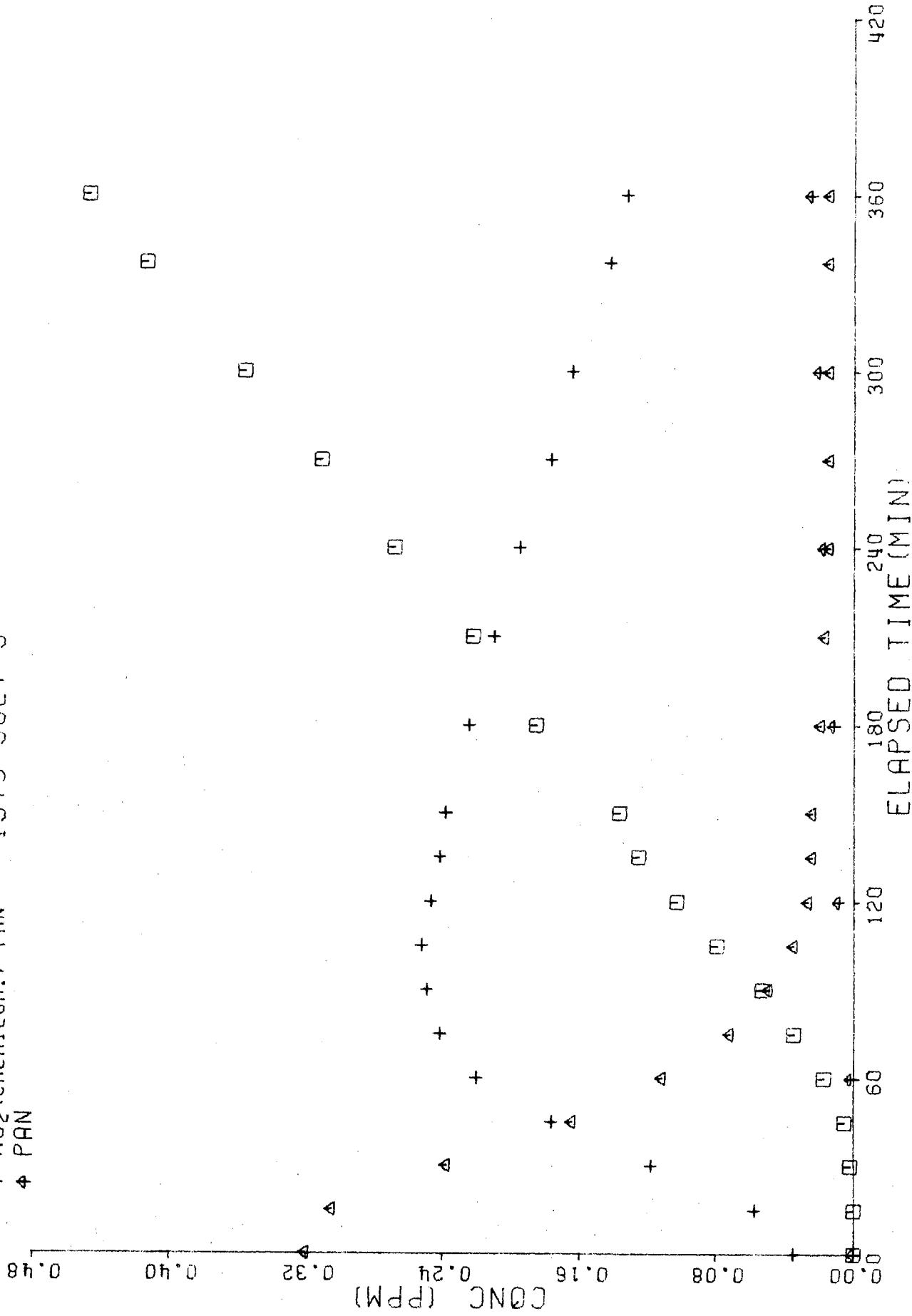
PLOT

DZONE 360.0 MIN TOTAL DOSAGE = 39.82 PPM-MIN
 NO 360.0 MIN TOTAL DOSAGE = 8.86 PPM-MIN
 NO2-PAN 360.0 MIN TOTAL DOSAGE = 18.87 PPM-MIN
 PAN 360.0 MIN TOTAL DOSAGE = 0.45 PPM-MIN
 OZONE DOSAGE GT 0.10 = 14.47 PPM-MIN
 OZONE DOSAGE GT 0.08 = 16.40 PPM-MIN
 NO2-PAN DOSAGE GT 0.25 = 0.0 PPM-MIN

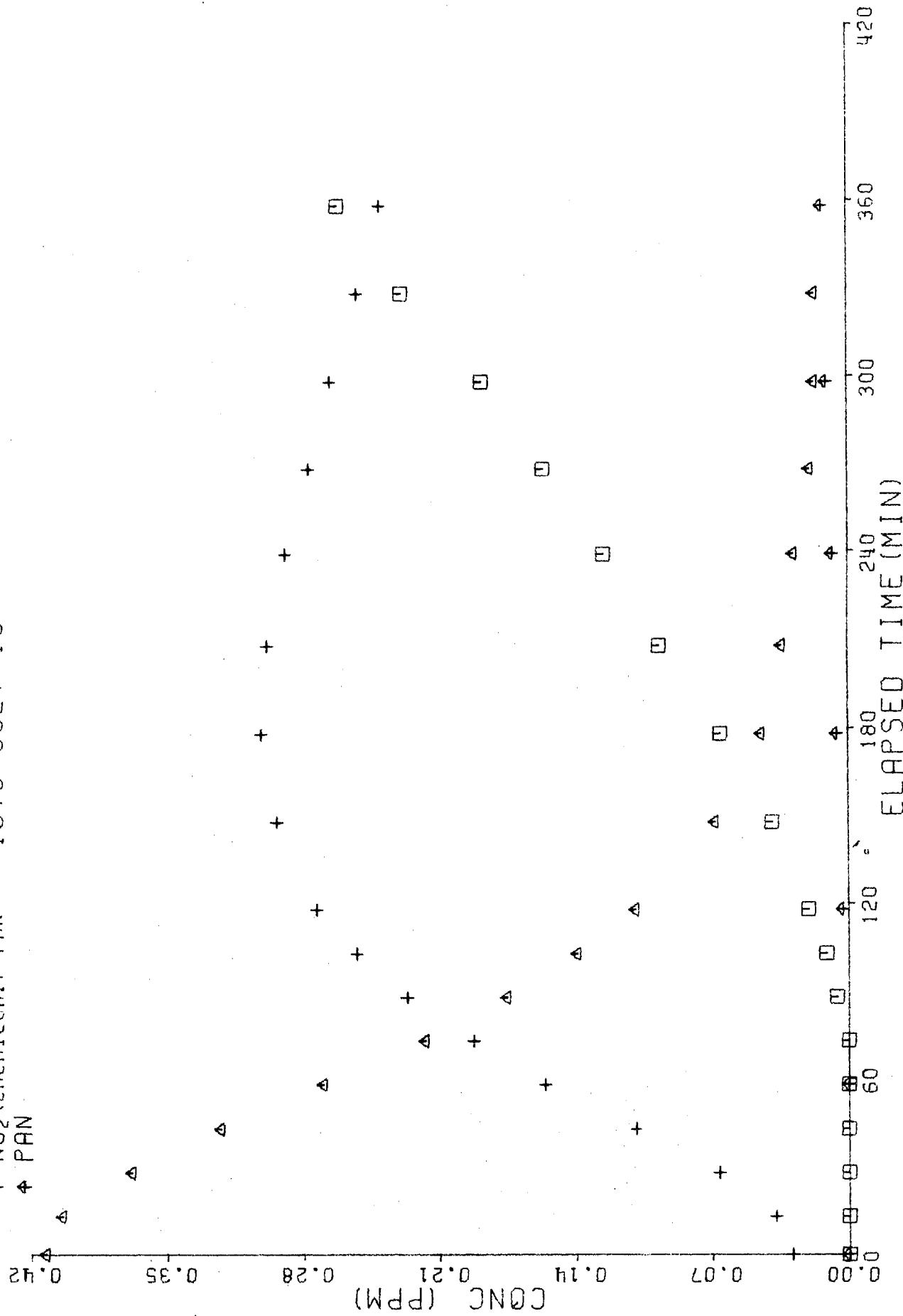
APPENDIX B

Inorganic Data Plots for Surrogate Runs 10-C through 73-G

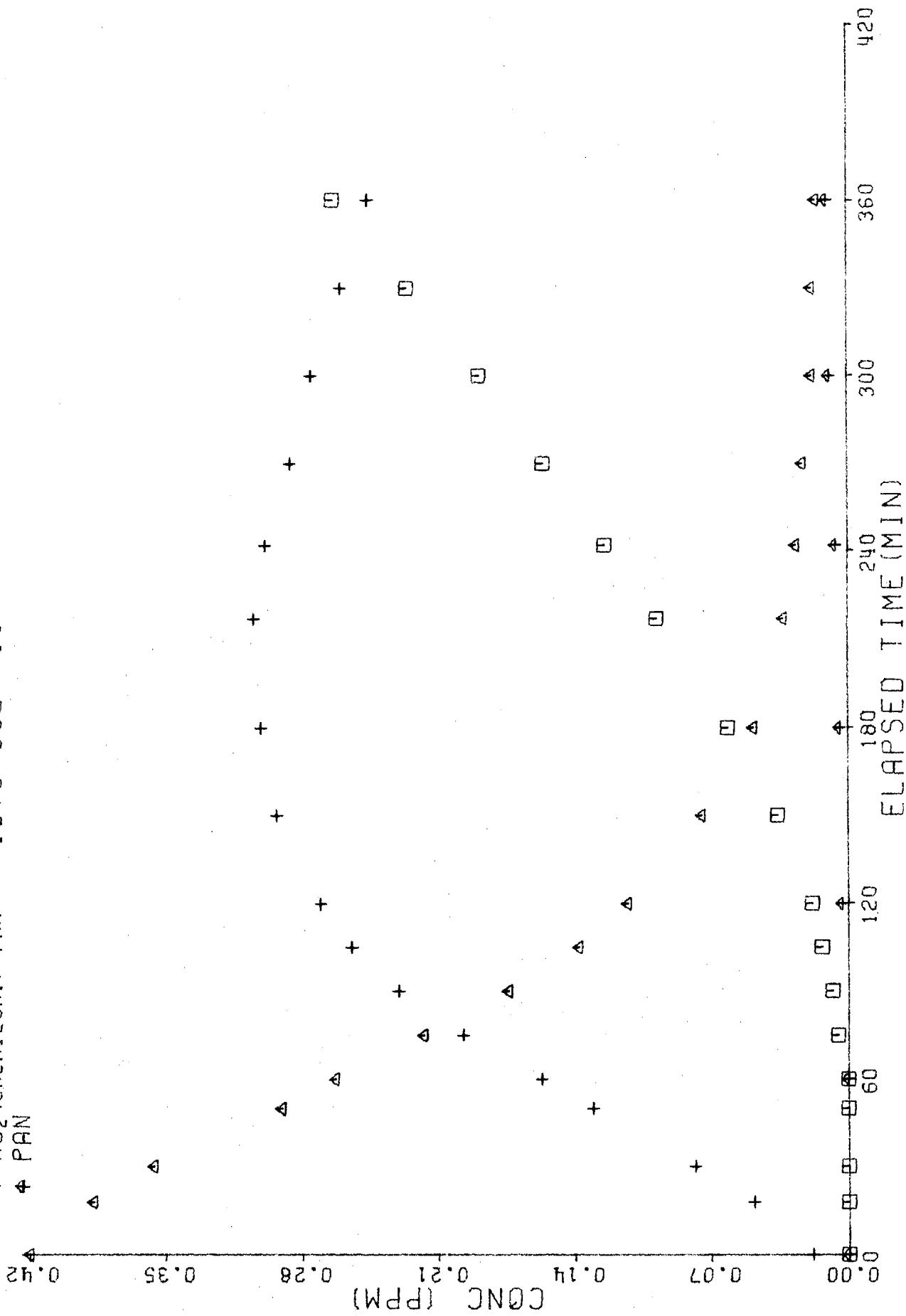
SURROGATE RUN 10-C
 GLASS CHAMBER
 1973 JULY 9
 NO₂ (CHEMILUM.) - PAN
 PAN



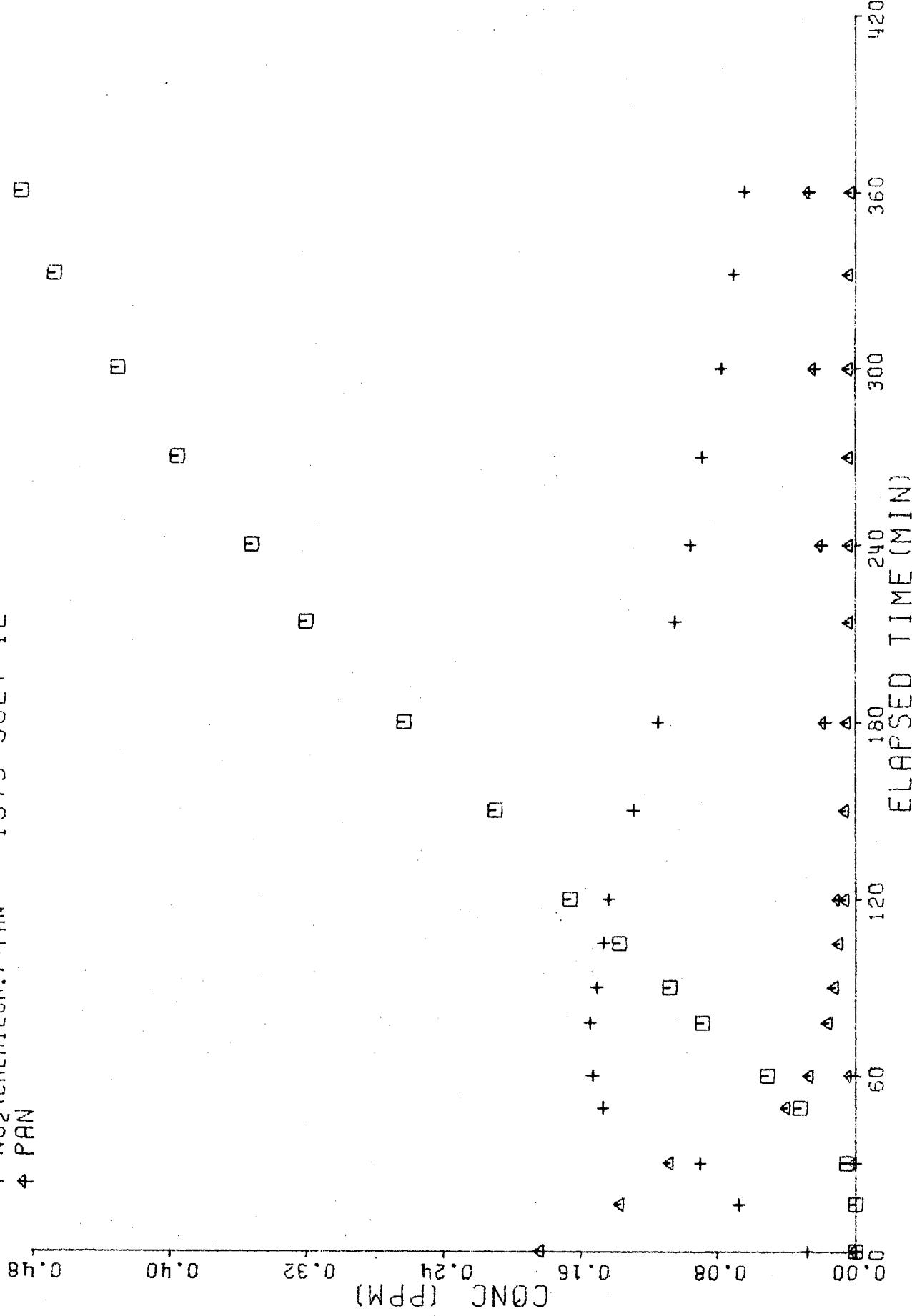
SURROGATE RUN 11-C
 GLASS CHAMBER
 1973 JULY 10
 OZONE NO NO_2 (CHEMILUM.) PAN PAN



SURROGATE RUN 12-C
 GLASS CHAMBER
 1973 JULY 11
 OZONE NO NO_2 (CHEMILUM.) - PAN PAN



SURROGATE RUN 13-C
 GLASS CHAMBER
 1973 JULY 12
 OZONE NO₂ (CHEMILUM.) - PAN
 + PAN



SURROGATE RUN 15-C
 GLASS CHAMBER
 1973 JULY 16
 OZONE NO₂ (CHEMILUM.) - PAN
 PAN

CONC (PPM) 0.00 0.08 0.16 0.24 0.32 0.40 0.48

420

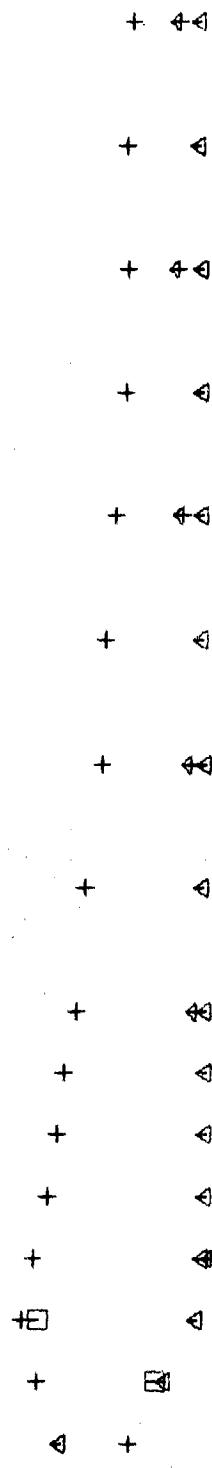
360

300

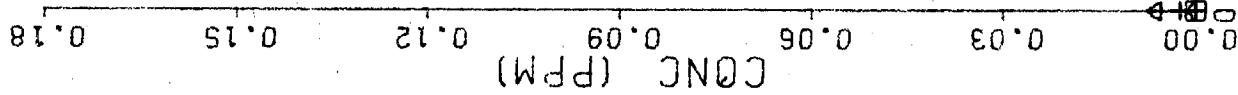
ELAPSED TIME (MIN)
 180 240

60

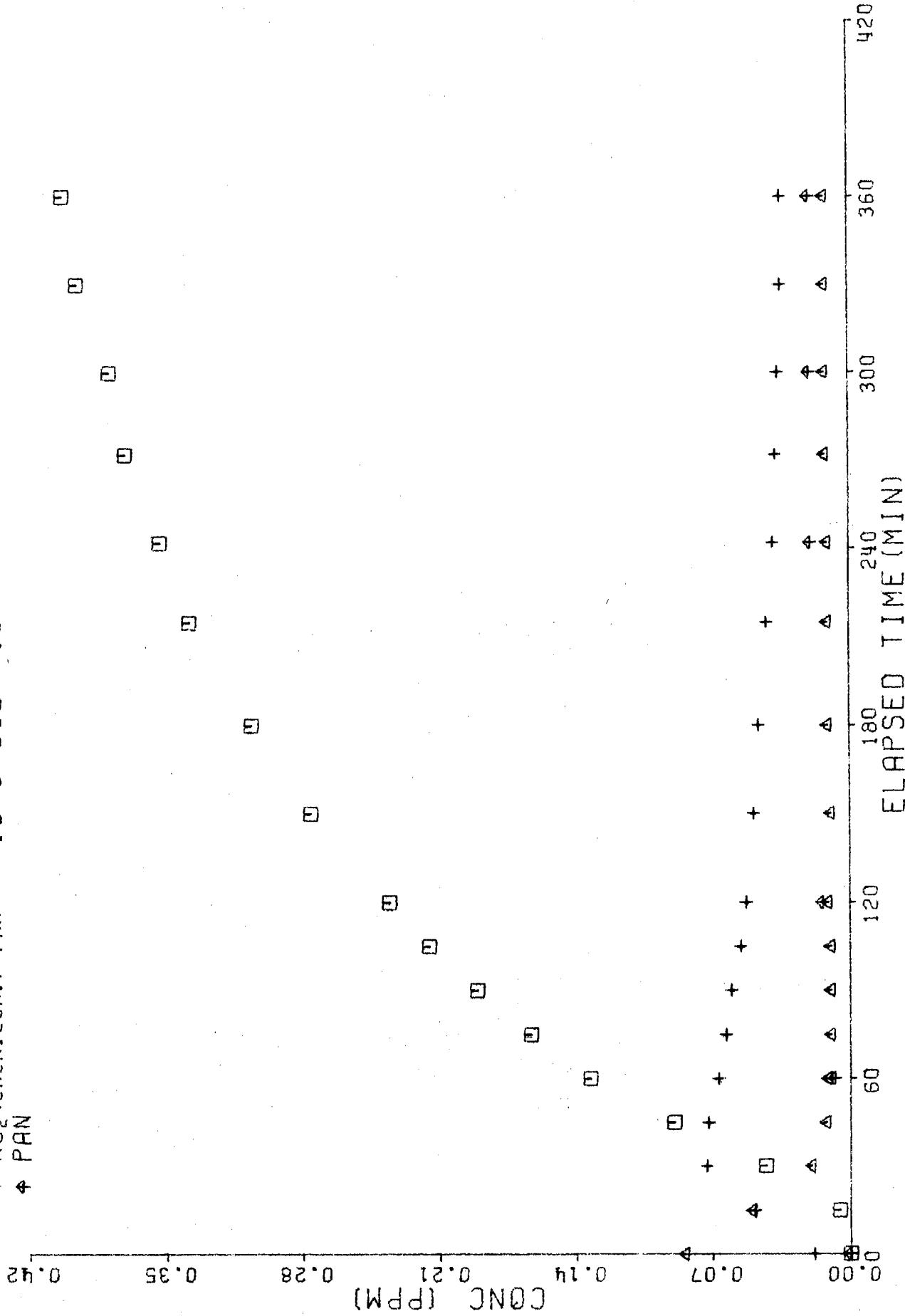
0.00



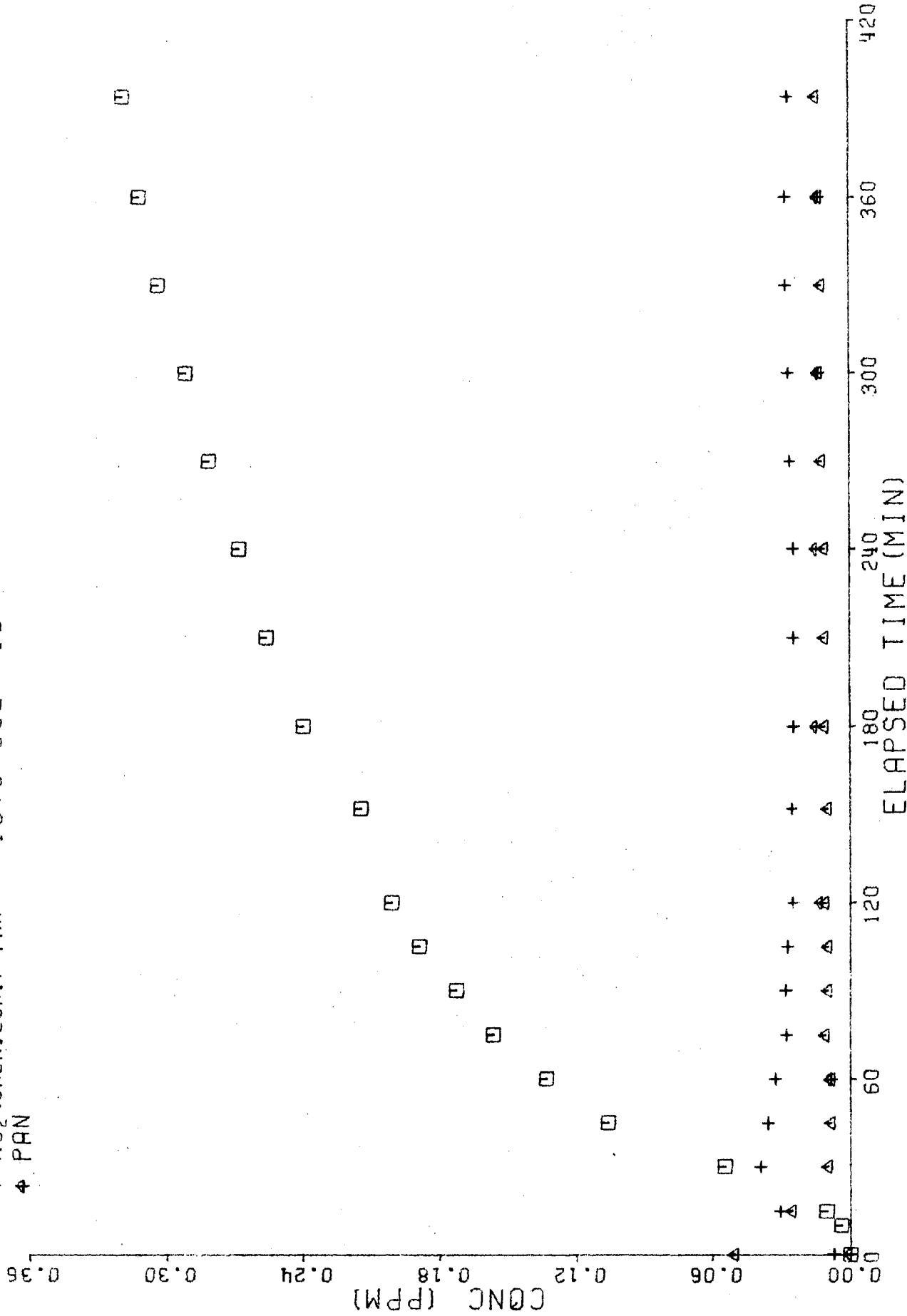
SURROGATE RUN 16-C
 GLASS CHAMBER
 1973 JULY 17
 NO₂ (CHEMILUM.) - PAN
 PAN



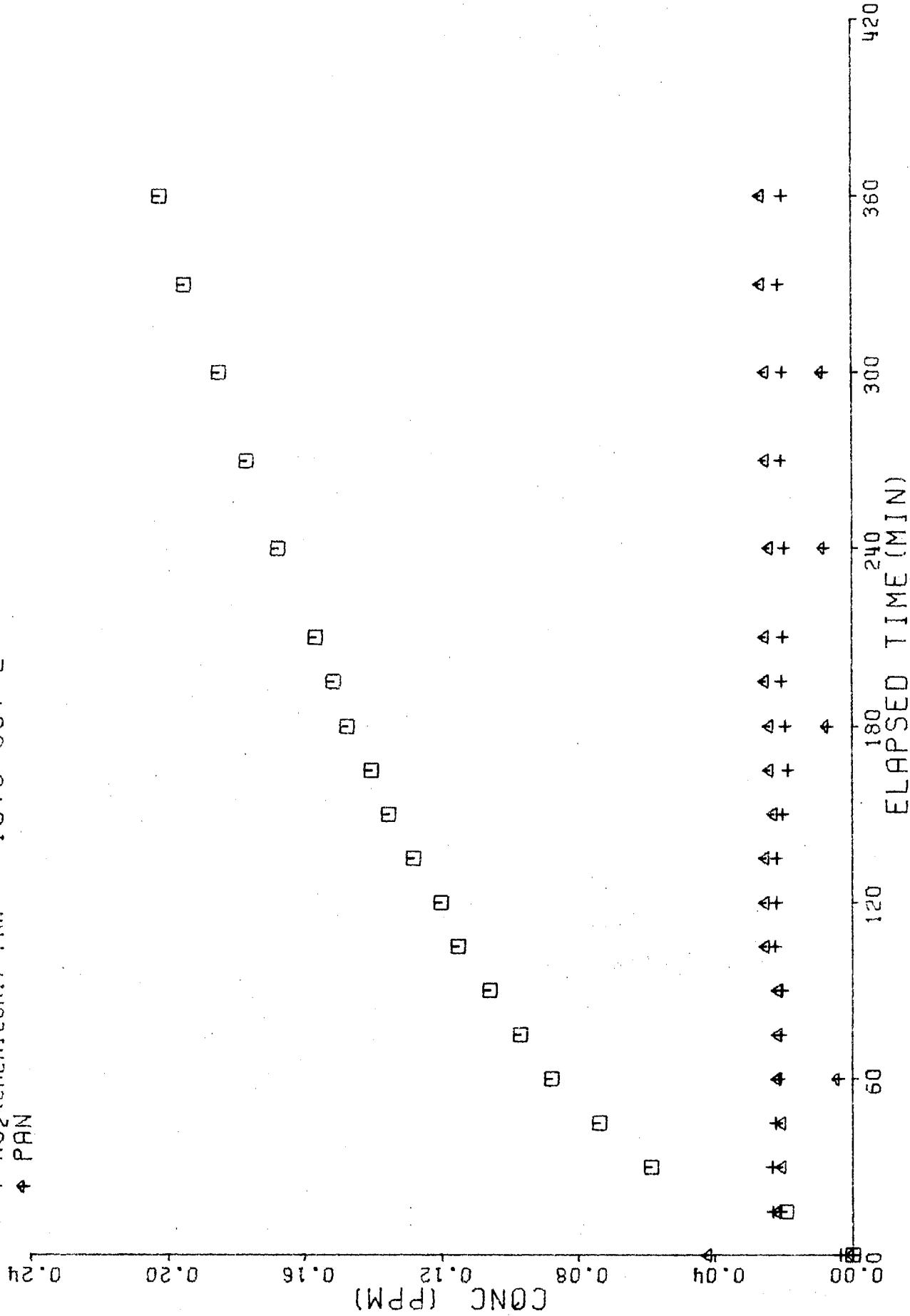
SURROGATE RUN 17-C
 GLASS CHAMBER
 1973 JULY 18
 NO₂ (CHEMILUM.) - PAN
 PAN



SURROGATE RUN 18-C
 GLASS CHAMBER
 1973 JULY 19
 NO₂ (CHEMILUM.) -PAN
 PAN

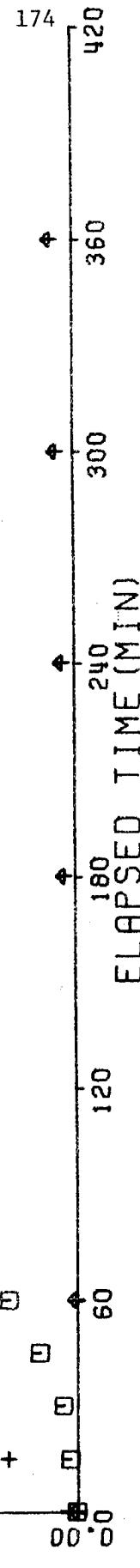


SURROGATE RUN 19-E
 GLASS CHAMBER
 1973 OCT 2
 NO₂ (CHEMILUM.) - PRN
 PAN



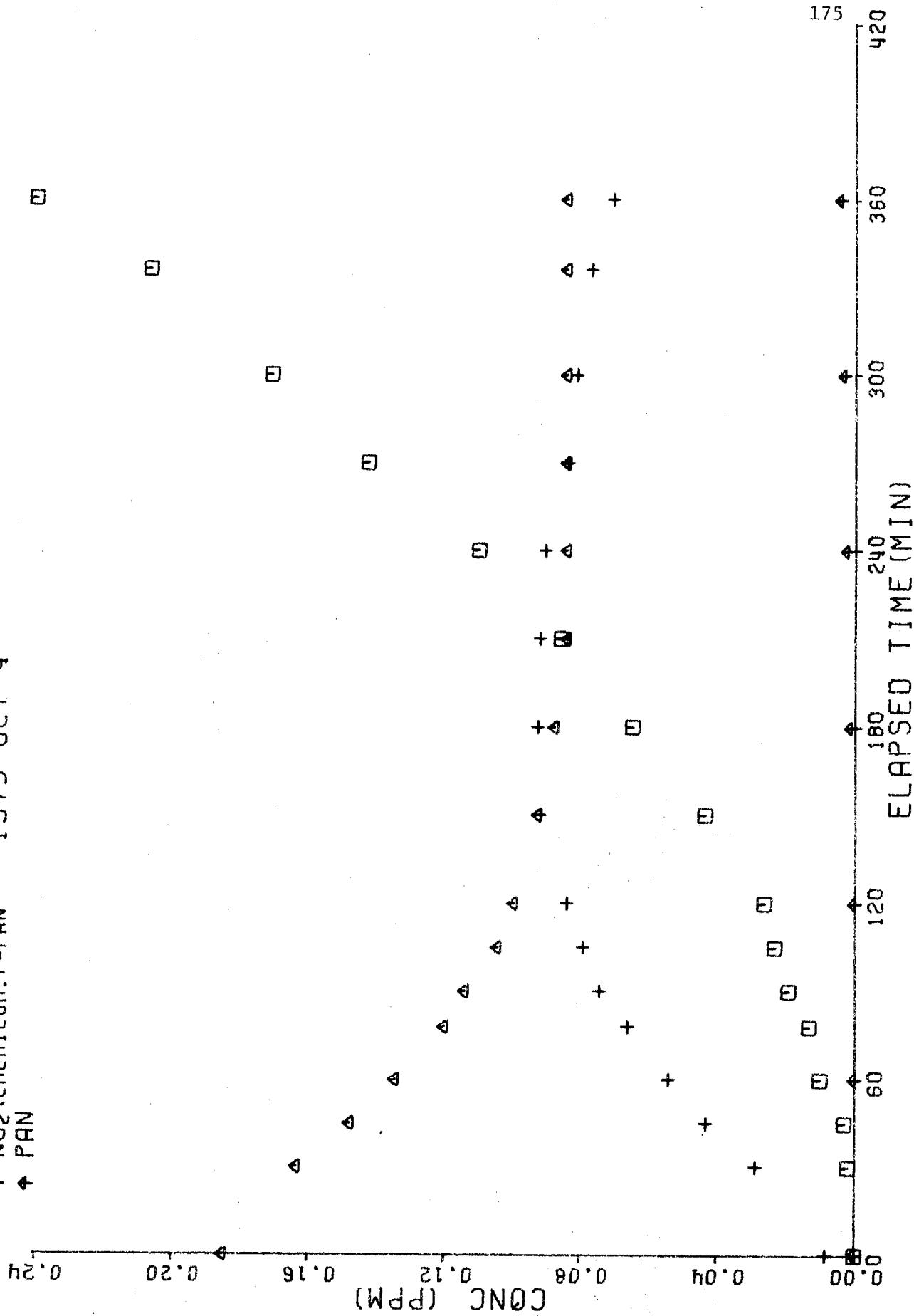
□ OZONE
▲ NO
+ NO₂ (CHEMILUM.) -PAN
◆ PAN

SURROGATE RUN 20-E
GLASS CHAMBER
1973 OCT 3

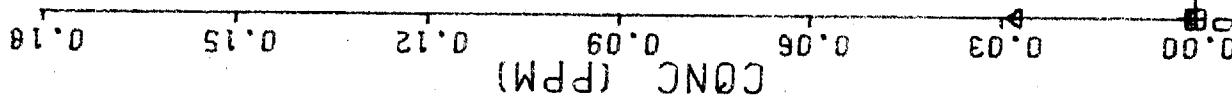


SURROGATE RUN 21-E
GLASS CHAMBER
1973 OCT 4

OZONE
NO
NO₂ (CHEMILUM.) - PAN
PAN



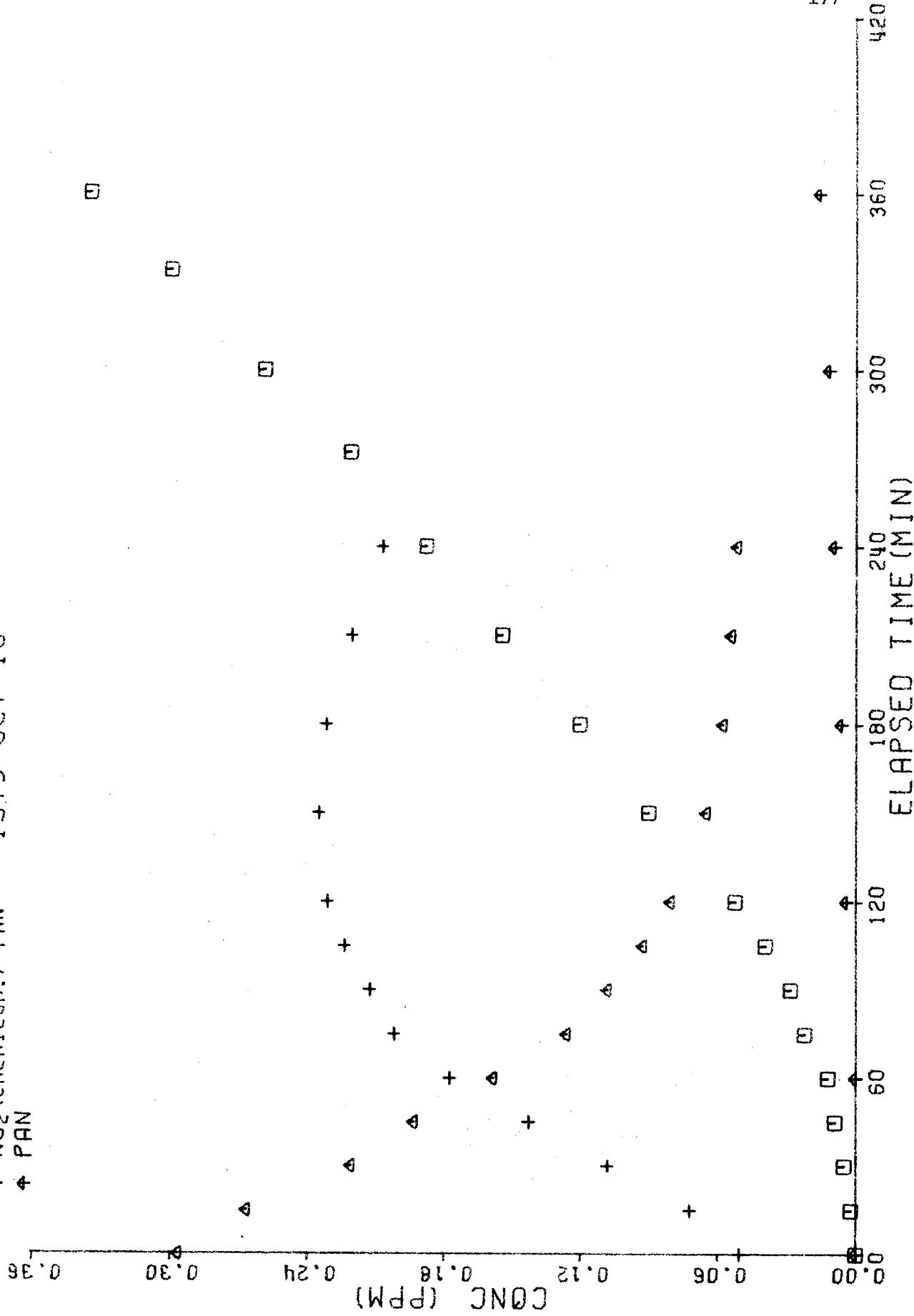
SURROGATE RUN 22-E
GLASS CHAMBER
1973 OCT 5
NO₂ (CHEMILUM.) - PAN
PAN



176
420

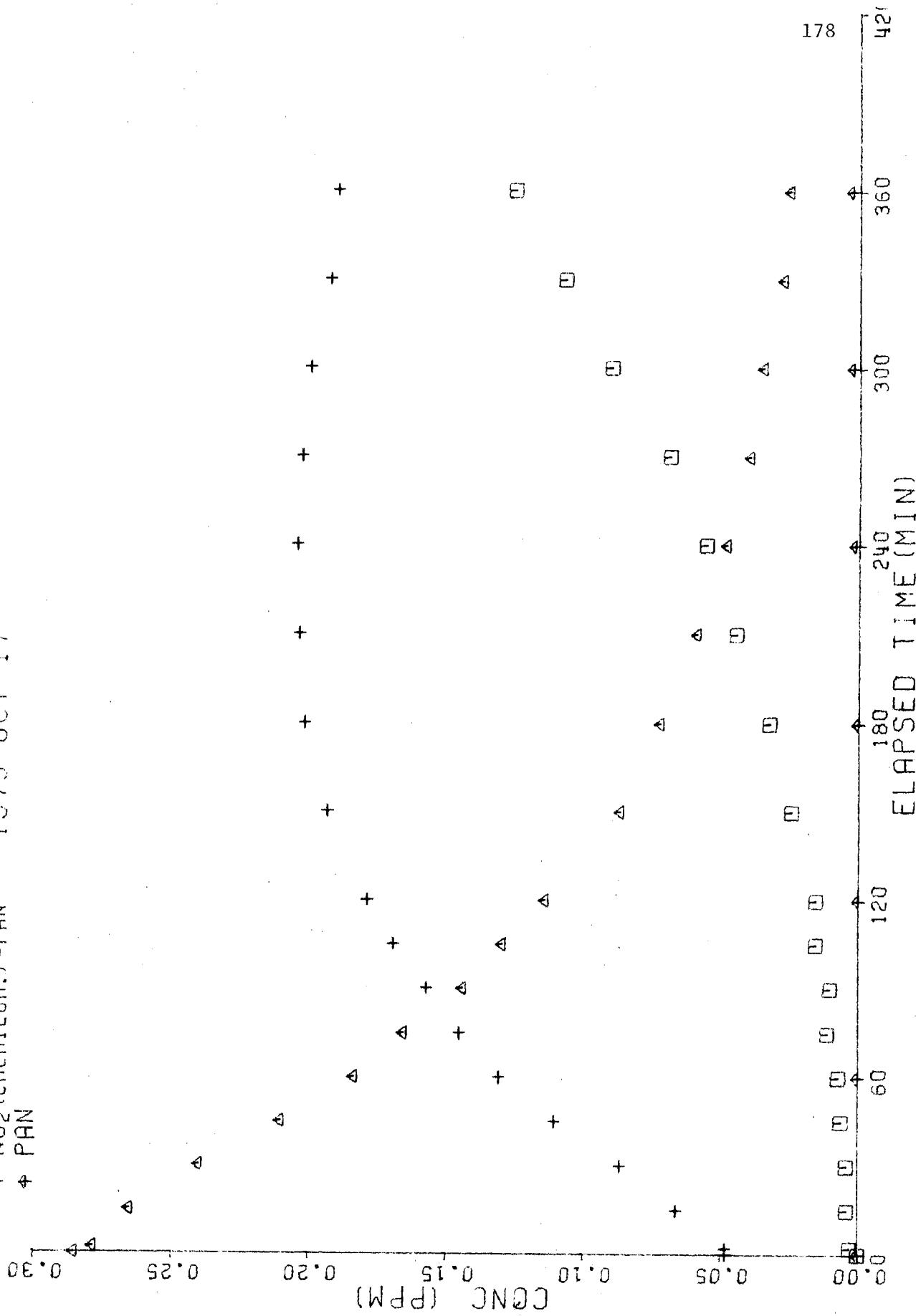
ELAPSED TIME (MIN)

SURROGATE RUN 23-E
 GLASS CHAMBER
 1973 OCT 10
 NO₂ (CHEMILUM.) -PAN
 PAN



□ OZONE
△ NO
+ NO₂ (CHEMILUM.) - PAN
* PAN

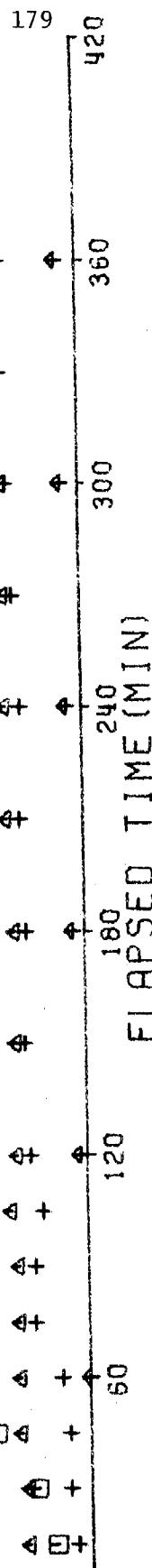
SURROGATE RUN 24-E
GLASS CHAMBER
1973 OCT 17



SURROGATE RUN 25-E
GLASS CHAMBER
1973 OCT 19

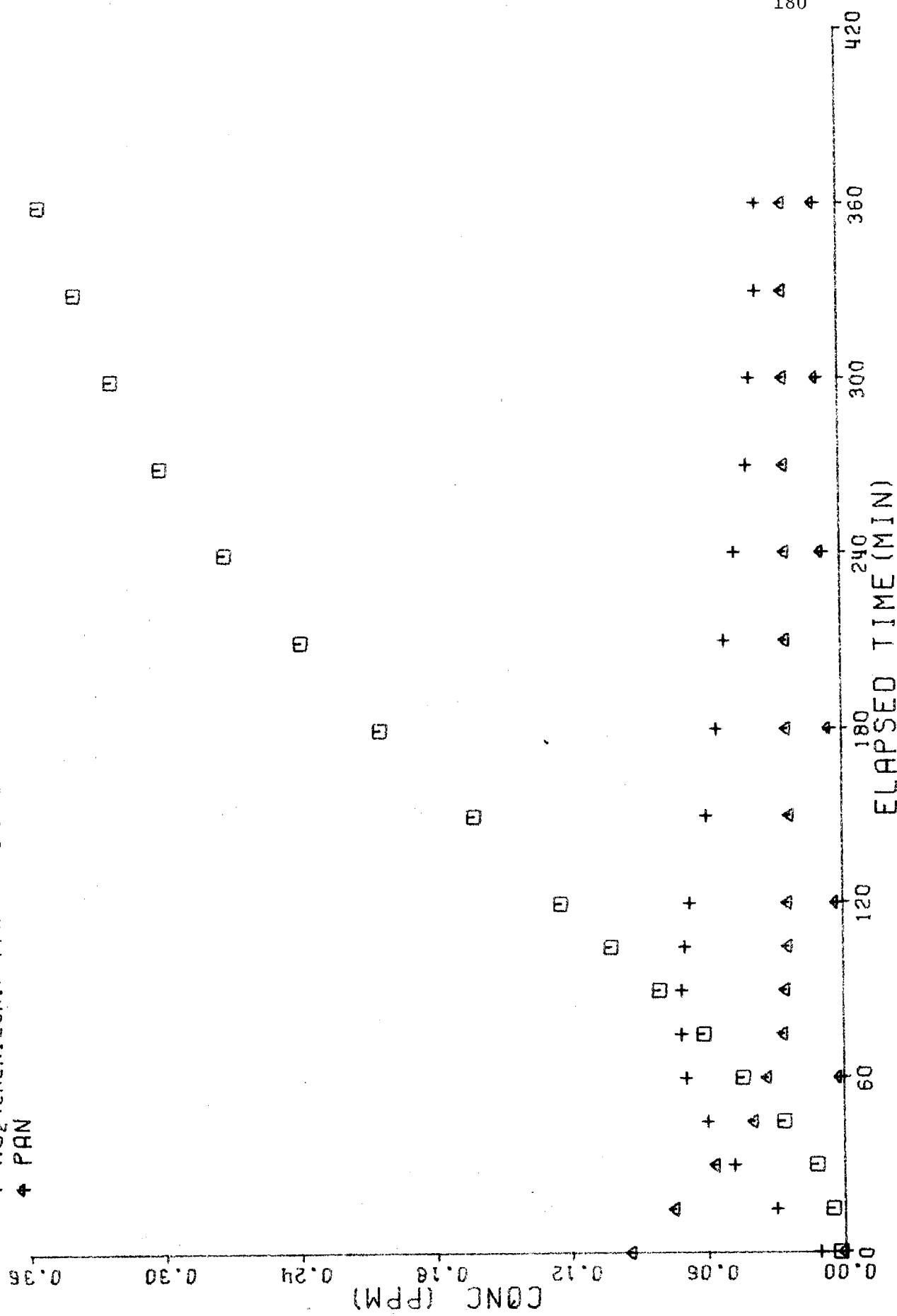
■ OZONE
▲ NO₂ (CHEMILUM.)-PAN
+ PAN

0.00 0.03 0.06 0.09 0.12 0.15 CONC (PPM)



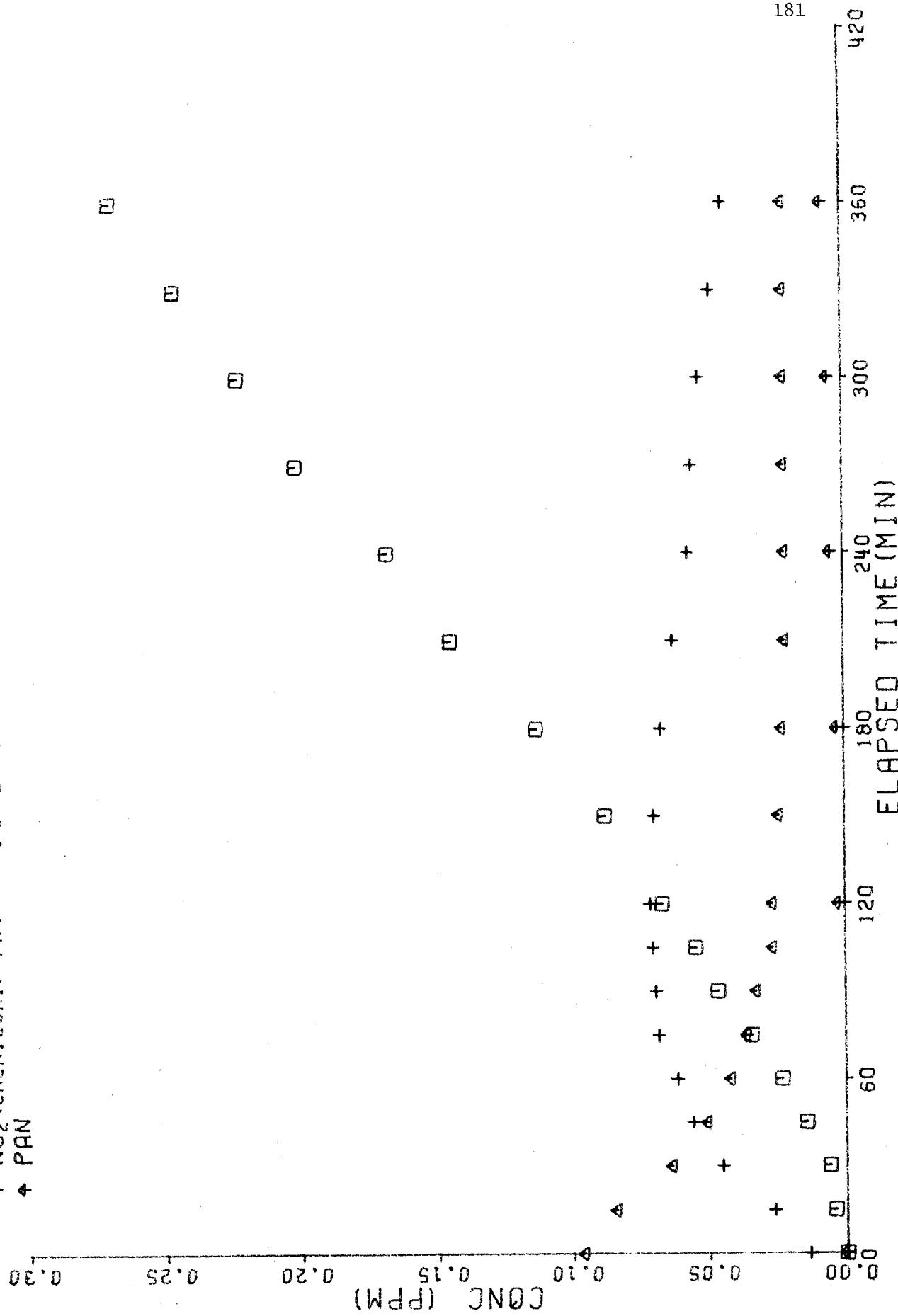
□ OZONE
 ▲ NO
 + NO₂ (CHEMILUM.) - PAN
 ♦ PAN

SURROGATE RUN 26-E
 GLASS CHAMBER
 1973 OCT 22

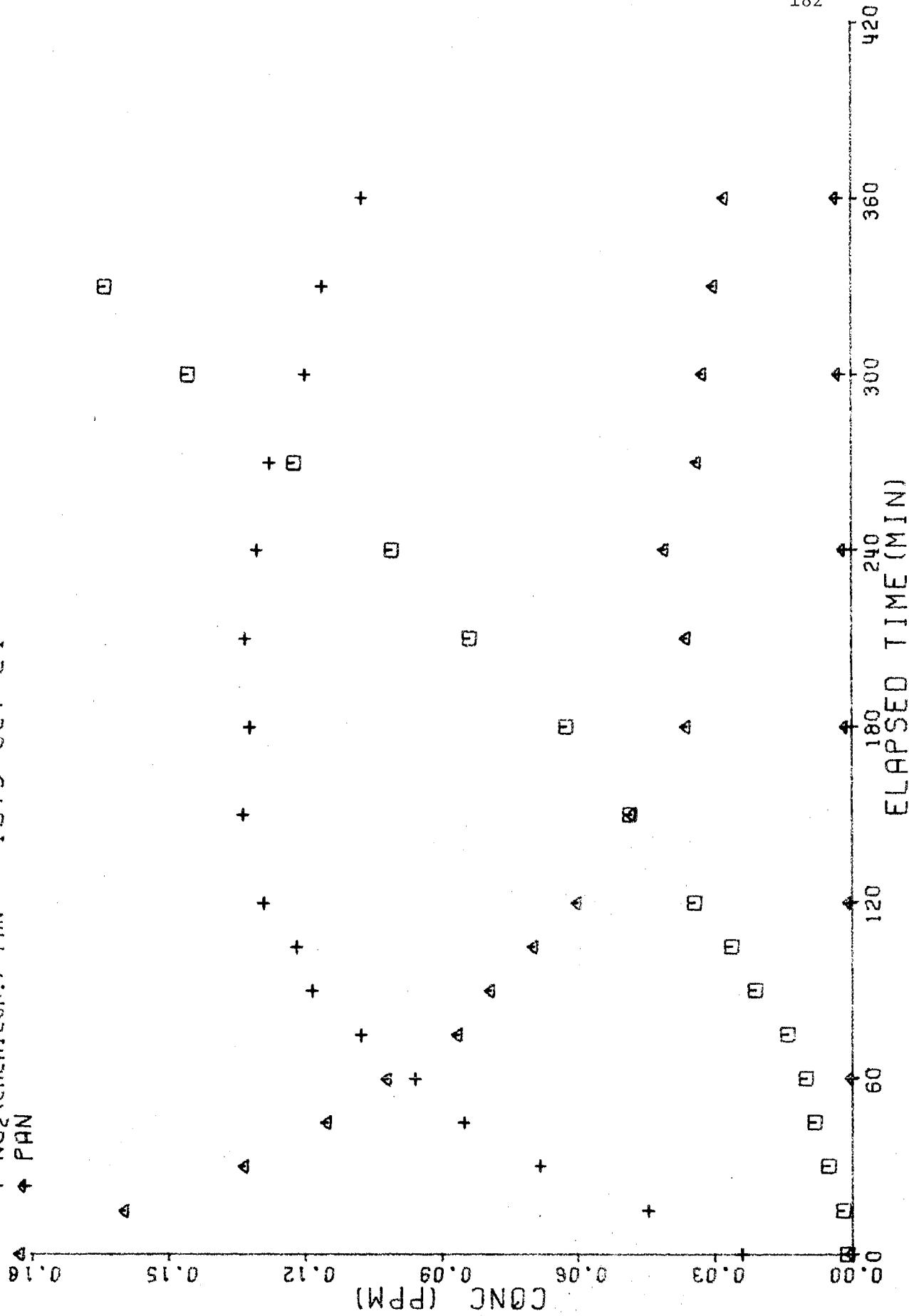


OZONE
 NO
 NO₂ (CHEMILUM.) - PAN
 PAN

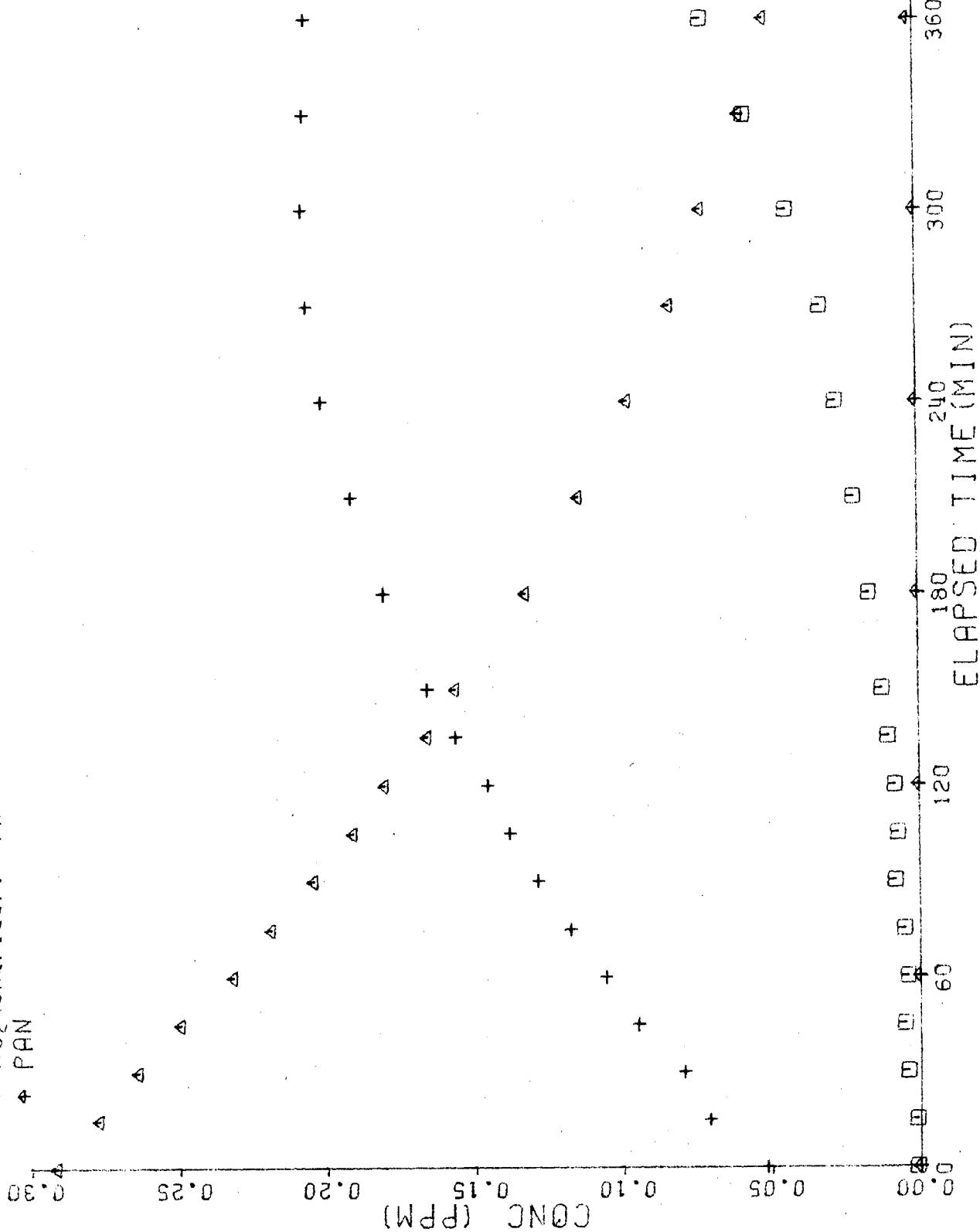
SURROGATE RUN 27-E
 GLASS CHAMBER
 1973 OCT 23



SURROGATE RUN 28-E
 GLASS CHAMBER
 1973 OCT 24
 OZONE
 NO
 + NO₂ (CHEMILUM.) - PAN
 PAN

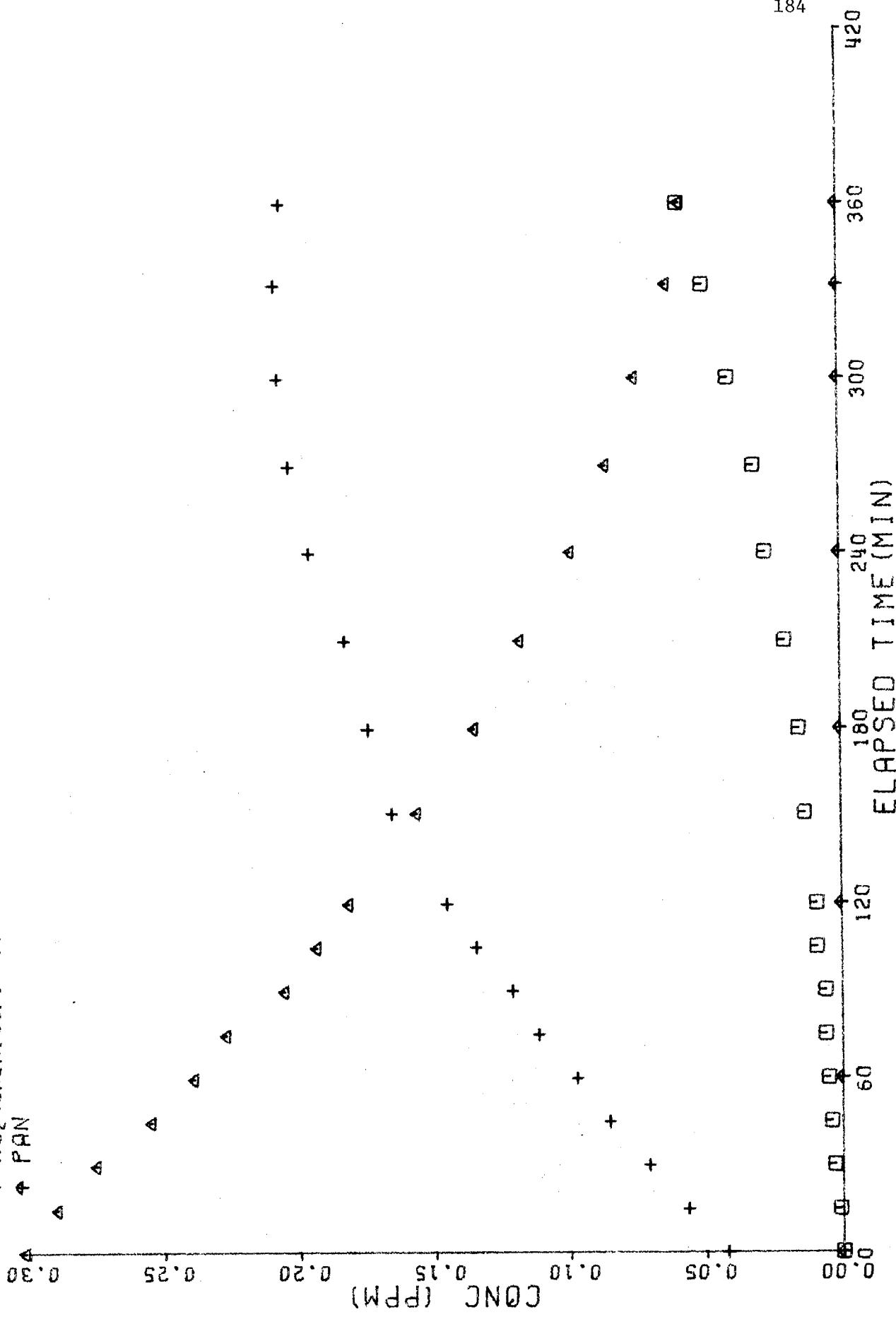


SURROGATE RUN 29-E
 CLASS CHAMBER
 1973 OCT 25
 NO₂ (CHEMILUM.) - PAN
 PAN



□ OZONE
 ▲ NO
 + NO₂ (CHENILUM. I)-PAN
 ♦ PAN

SURROGATE RUN 30-E
 GLASS CHAMBER
 1973 OCT 26



184

420

SURROGATE RUN 31-E
 CLASS CHAMBER
 1973 OCT 29

\square OZONE
 \triangle NO
 $+$ NO₂ (CHEMILUM.)-PAN
 \blacktriangleleft PAN

CONC (PPM)

ELAPSED TIME (MIN)

120 180 240 300 360 420

◻ OZONE
△ NO
+ NO₂ (CHMILUM.) - PAN
◆ PAN

SURROGATE RUN 32-E
GLASS CHAMBER
1973 OCT 31

0.24

0.20

0.16

0.12

0.08

0.04

0.00

CONC (PPM)

0.00

0.00

120 180 240

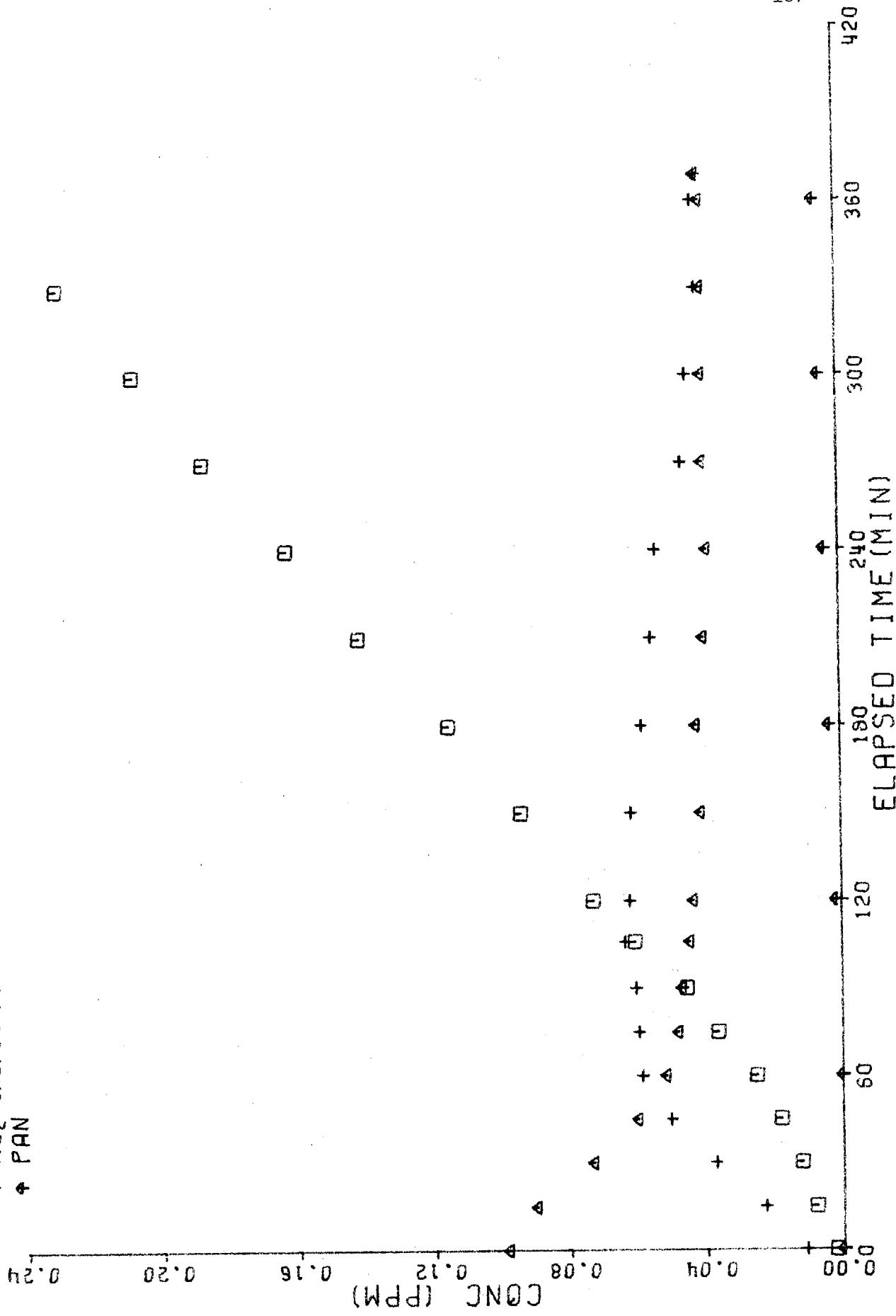
ELAPSED TIME (MIN)

60 120 180 240

300 360 420

186 420

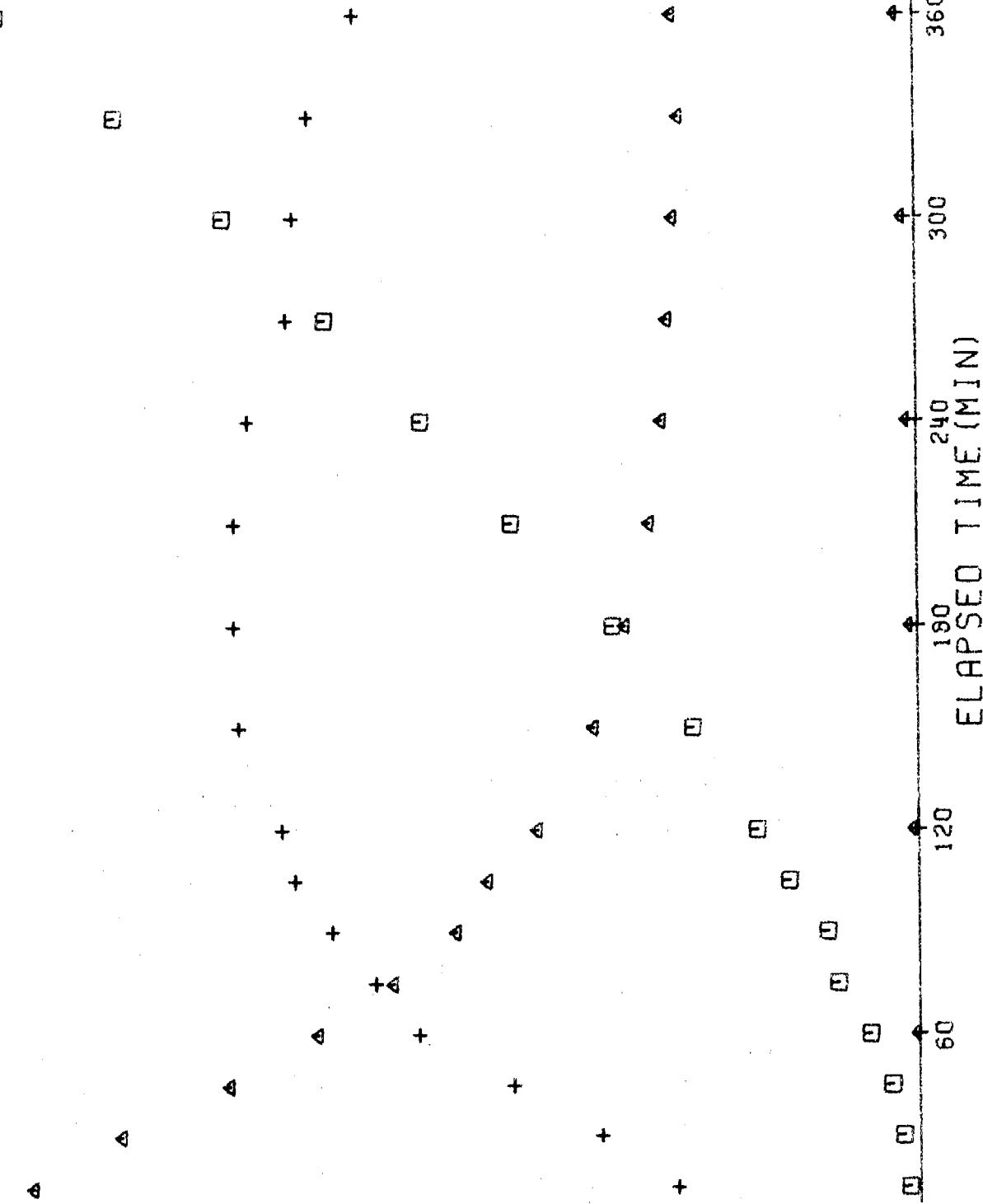
SURROGATE RUN 34-E
 GLASS CHAMBER
 1973 NOV 6
 OZONE NO NO₂ (CHEMILUM.) - PAN
 + PAN



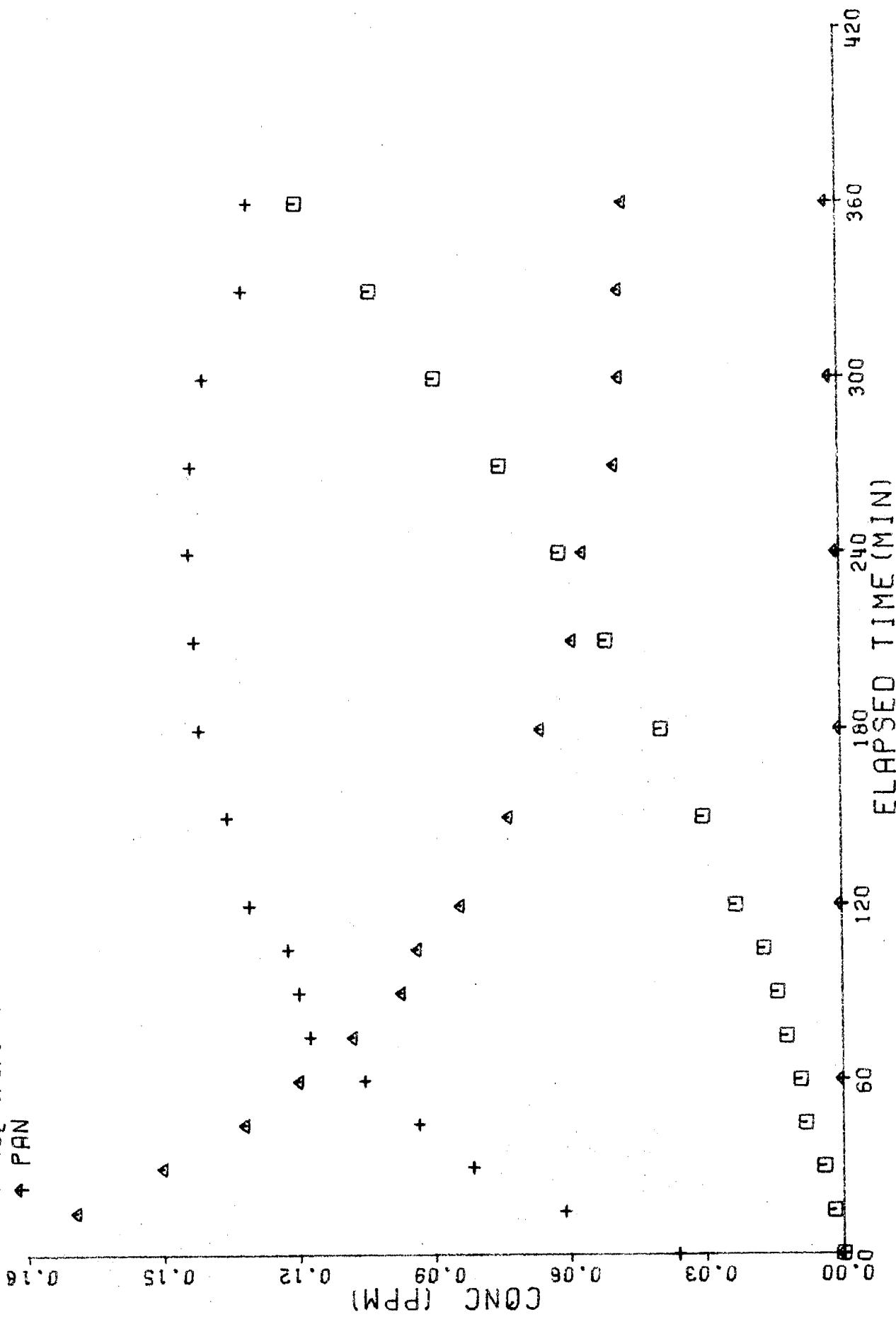
SURROGATE RUN 35-E
GLASS CHAMBER
1973 NOV 7

◻ OZONE
◀ NO
+ NO₂ (CHEMILUM.) - PAN
◀ PAN

CONC (PPM)

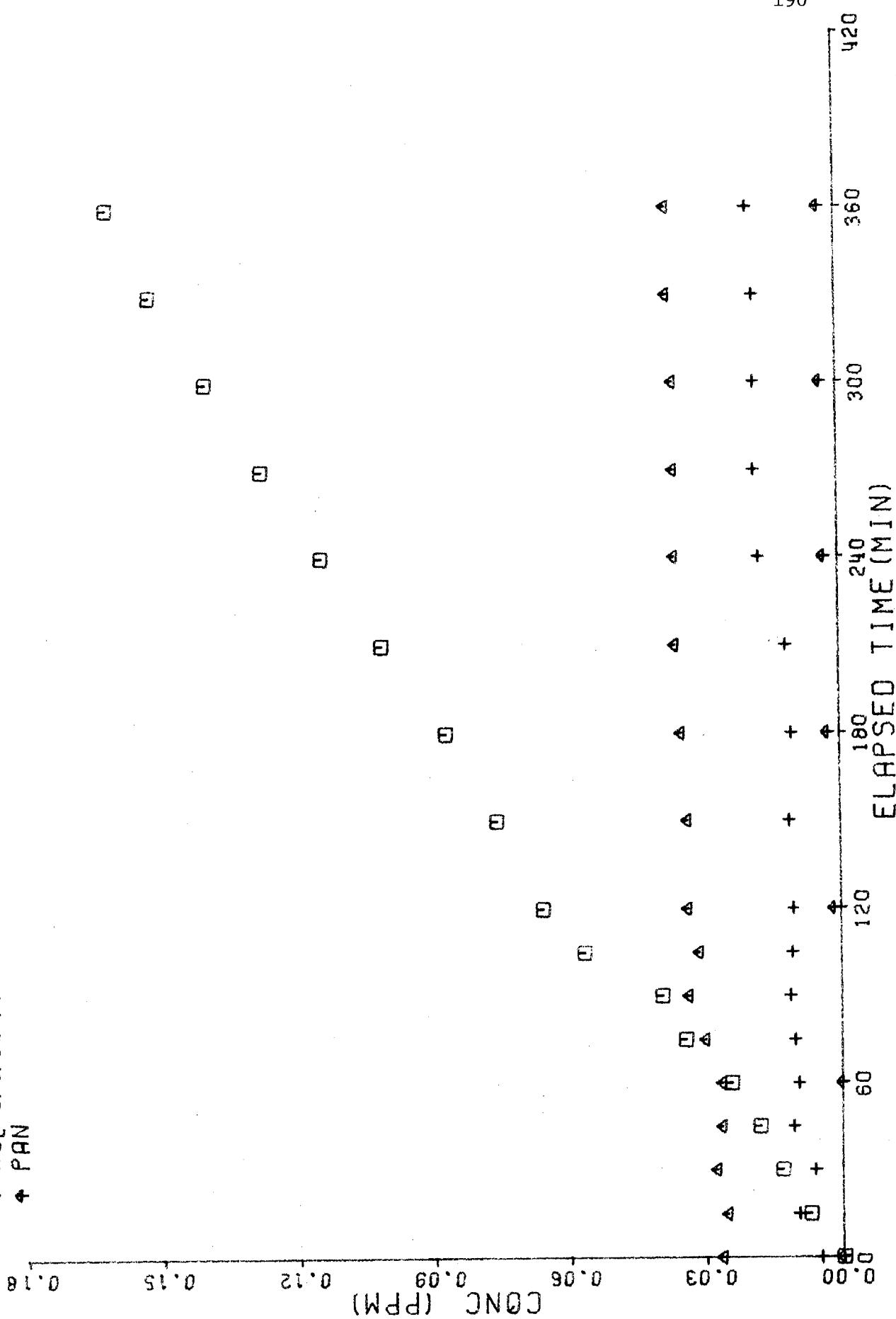


SURROGATE RUN 36-E
 GLASS CHAMBER
 1.973 NOV 8
 OZONE
 NO
 + NO₂ (CHEMILUM.) - PAN
 PAN



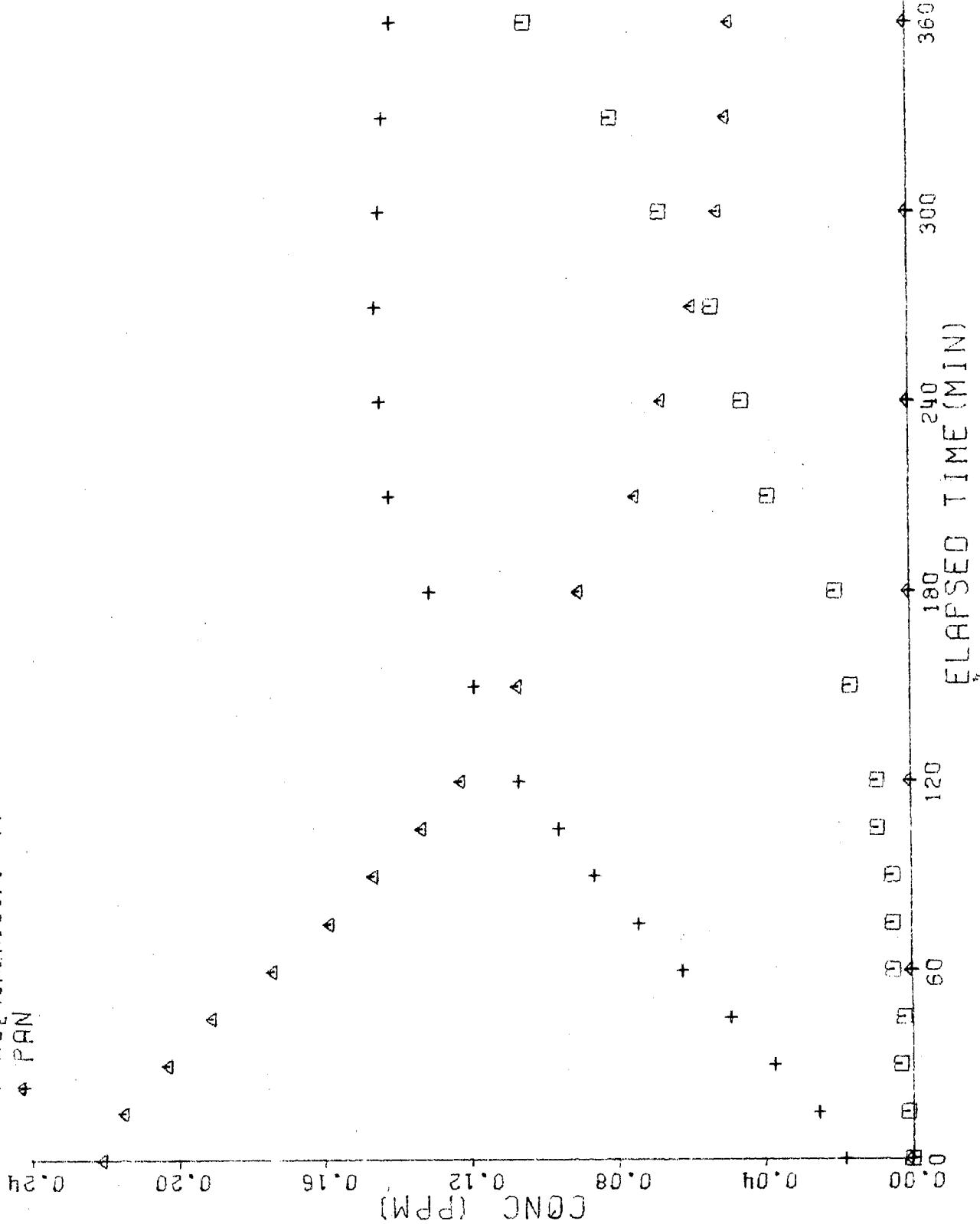
O OZONE
 ▲ NO
 + NO₂ (CHEMILUM.) - PAN
 ♦ PAN

SURROGATE RUN 37-E
 GLASS CHAMBER
 1973 NOV 3



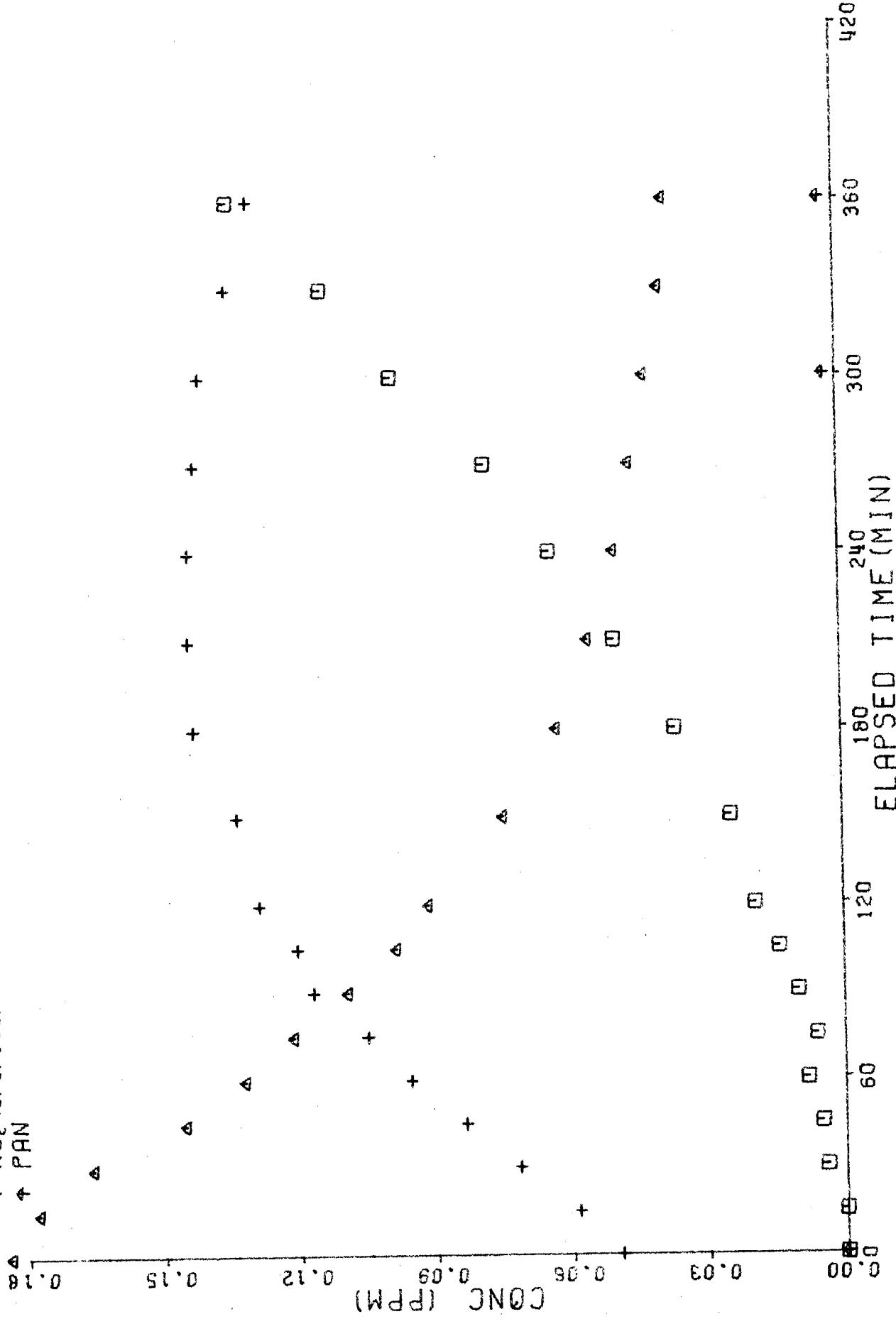
SURROGATE RUN 38-E
 GLASS CHAMBER
 1973 NOV 13

OZONE
 NO
 + NO₂ (CHEMILUM.) - FAN
 PAN

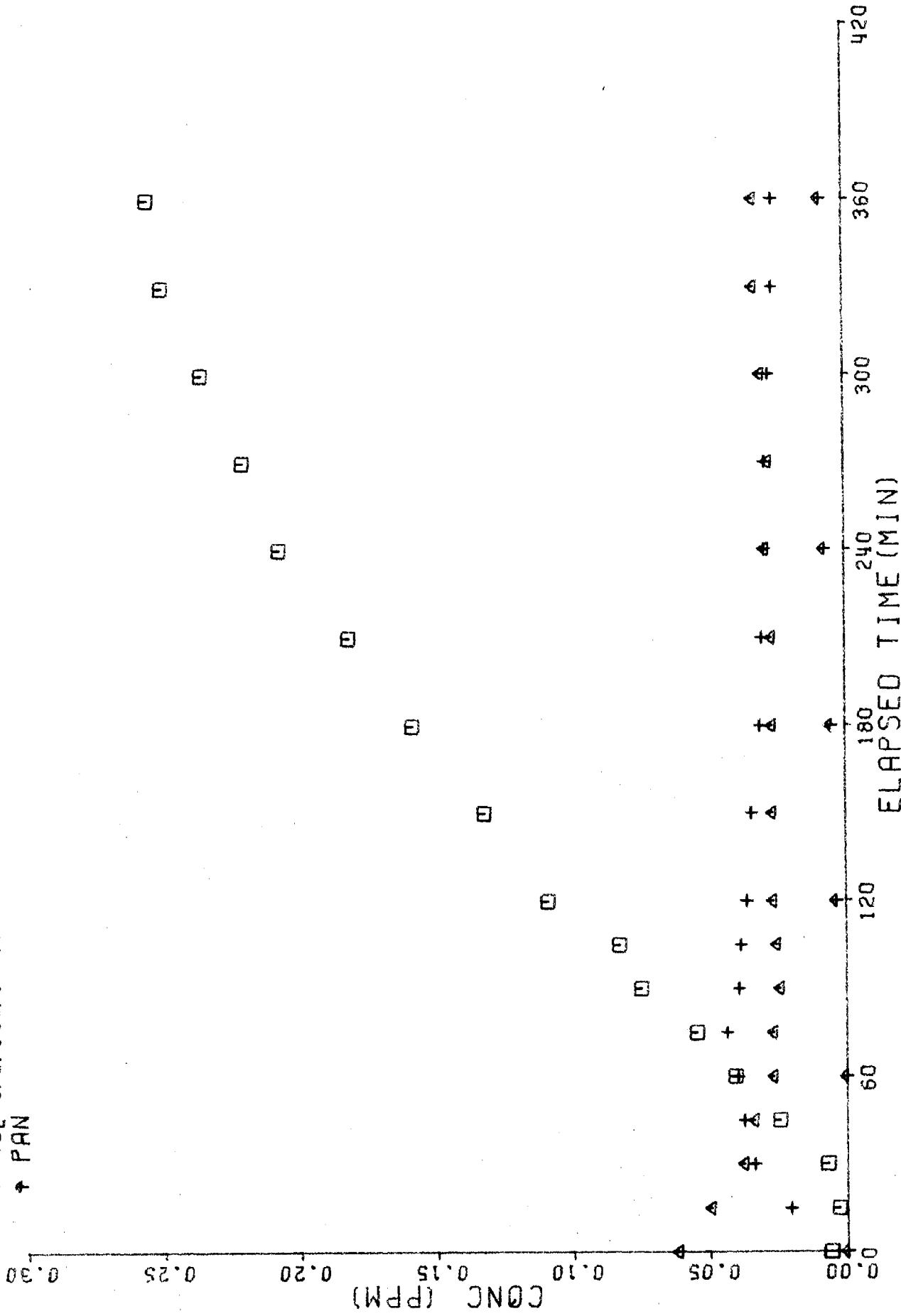


SURROGATE RUN 39-E
GLASS CHAMBER
1973 NOV 14

□ OZONE
△ NO
+ NO₂ (CHEMILUM.) - PAN
◆ PAN

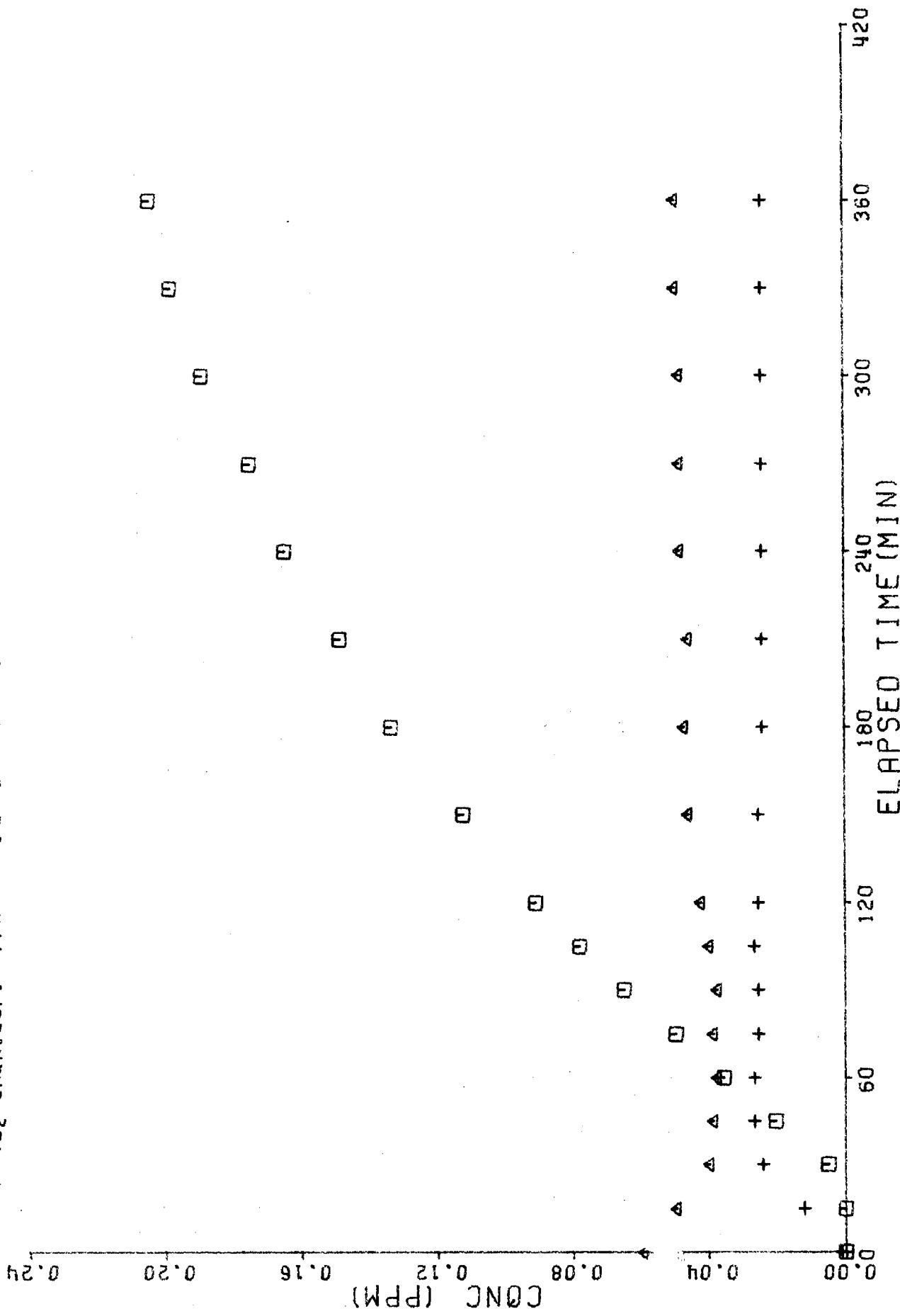


OZONE SURROGATE RUN 40-E
 NO GLASS CHAMBER
 + NO₂ (CHEMILUM.) - PAN
 ♦ PAN

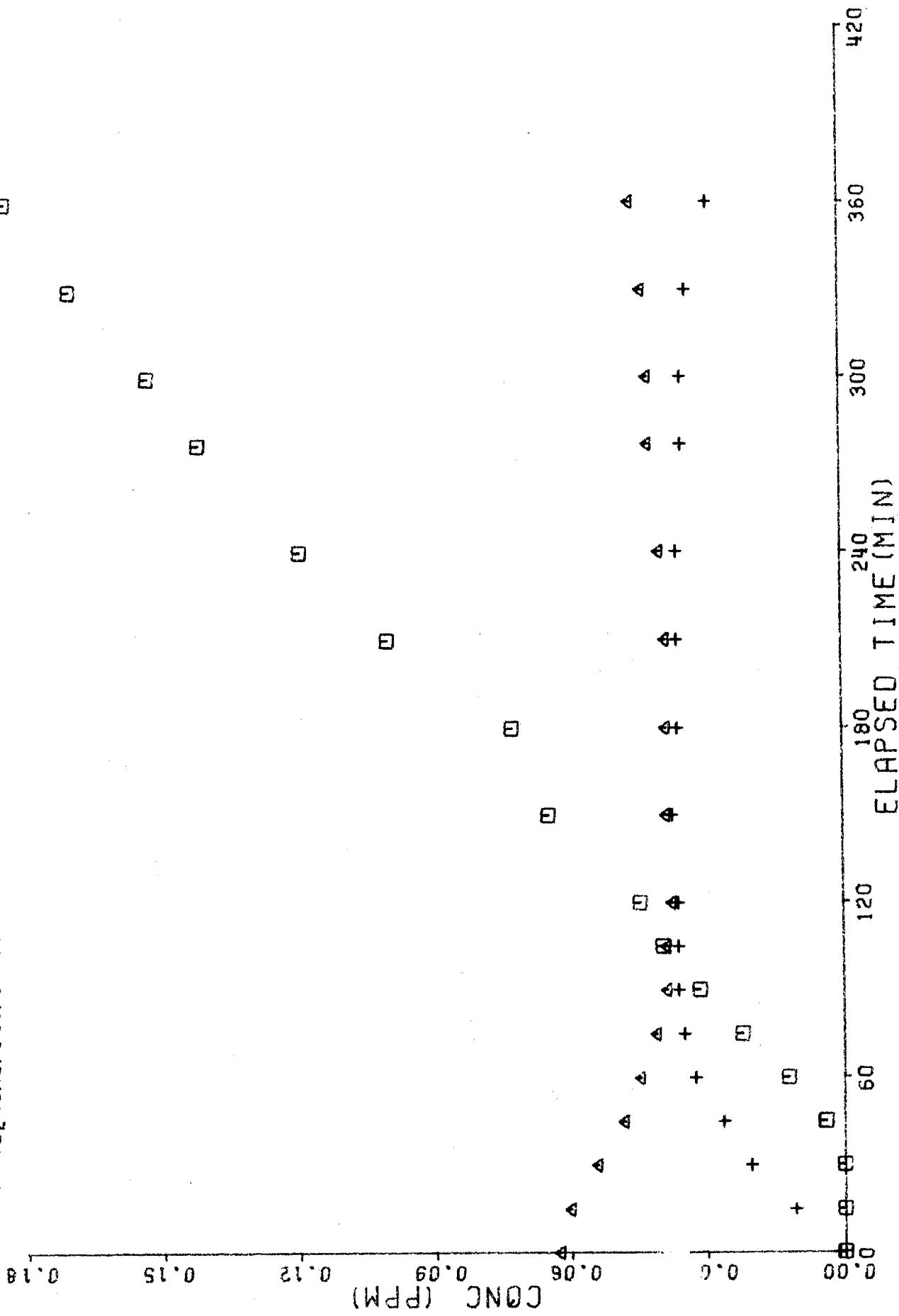


SURROGATE RUN 41-E
GLASS CHAMBER
1973 NOV 27

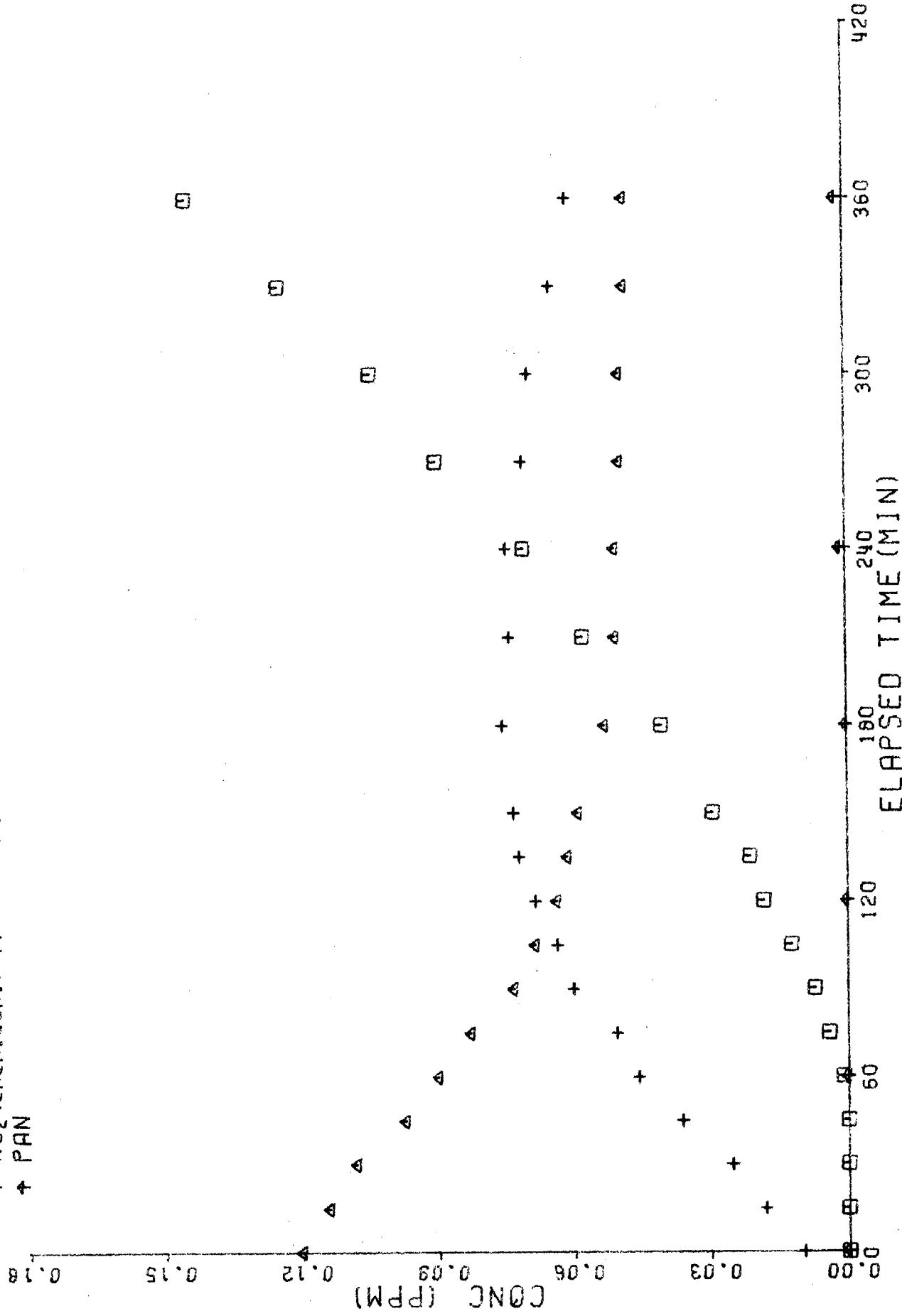
◻ OZONE
▲ NO
+ NO₂ (CHEMILUM.) - PAN



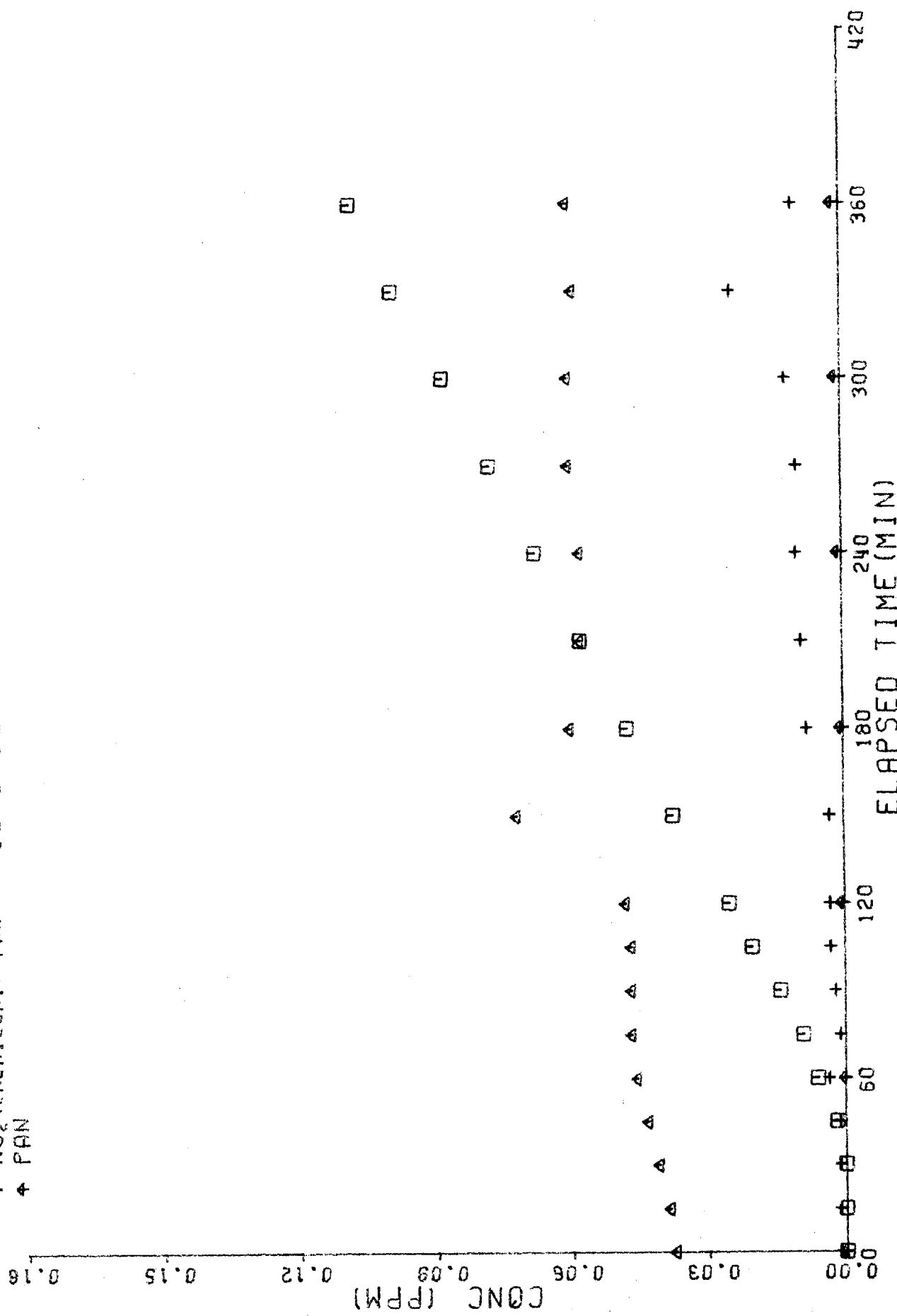
SURROGATE RUN 42-E
 GLASS CHAMBER
 1973 NOV 29
 OZONE
 NO
 + NO₂ (CHEMILUM.) -PAN



SURROGATE RUN 43-E
 GLASS CHAMBER
 1973 NOV 30
 OZONE
 NO
 + NO₂ (CHEMILUM.) - PAN
 PAN

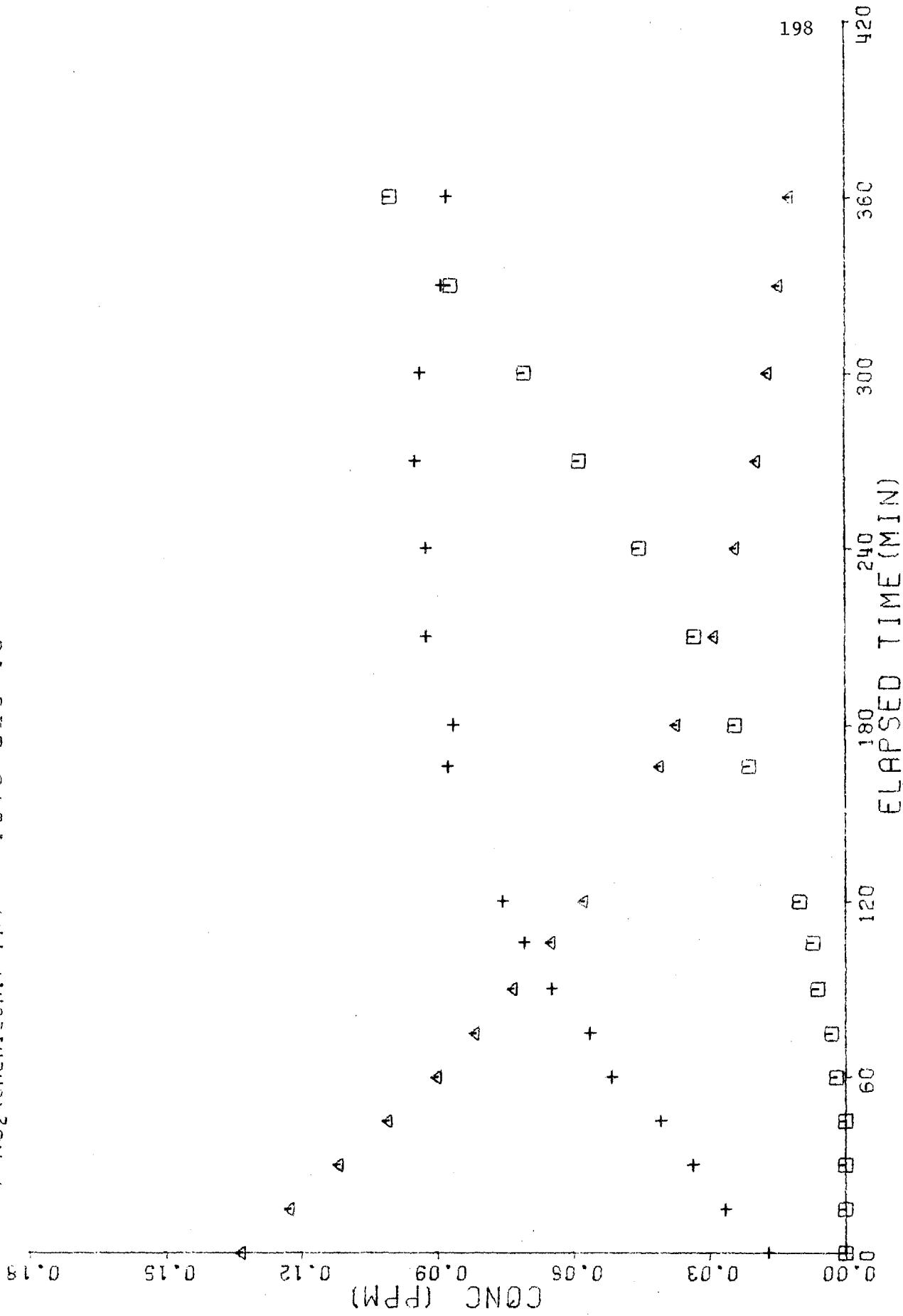


SURROGATE RUN 44-E
 GLASS CHAMBER
 1973 DEC 3
 OZONE
 NO
 + NO₂ (CHEMILUM.) - PAN
 PAN



◻ OZONE
△ NO
+ NO₂ (CHEMILUM.) - PAN

SURROGATE RUN 45-E
GLASS CHAMBER
1975 DEC 13



SURROGATE RUN 46-E
 CLASS CHAMBER
 + NO₂ (CHEMILUM.) - PAN
 1973 DEC 18

